

Demand for Rail: transport options for the
Waimakariri District

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Abstract

The purpose of this research was to investigate the feasibility of a passenger rail service operating on a current rail line in Canterbury, known as the Main North Line, which connects the Waimakariri District to Christchurch. The Main North Line runs through the two main urban areas of the Waimakariri District: Rangiora and Kaiapoi. The need for research into the potential use of the Main North Line for passenger services has arisen due to increasing car congestion on arterial roads between the Waimakariri District and Christchurch. All traffic coming from the Waimakariri District into Christchurch must cross the Waimakariri River, creating a transport bottleneck. An assessment of the location of the Main North Line was conducted with respect to the travel needs of Waimakariri District residents using Geographic Information Systems (GIS) to investigate how far residents live and work from the line and resident surveys to determine whether people would use rail as their main mode of travel into Christchurch. Assessment of the infrastructure was with regard to the locations of potential railways stations and the capabilities of the infrastructure for supporting different levels of passenger service. National and regional transport strategies are placing more importance on the transportation of people and freight by way of rail. A potential rail service for Canterbury will therefore likely include national and regional stakeholders in co-operation with a private service operator, as currently occurs in Wellington and Auckland. An average of 71% of Waimakariri District residents stated they would switch to rail as their main mode of transport for the journey into Christchurch. GIS analysis found that the number of journeys which start in the Waimakariri District and terminate within 1km of Christchurch stations is around 610 which increases to around 4,300 if connecting bus services were utilised in Christchurch.

Chapter One:

Introduction

This Chapter details the overall rationale behind this research into public transport and in particular passenger rail services.

This Chapter also describes the primary aims and objectives that this research will attempt to achieve

1.1 Rationale

New Zealand has a strong historical affinity with both passenger and freight rail transport. New Zealand's first railway opened in Nelson in 1862 and was one of the first operational train lines in the world (Leitch, 1972). Rail was essential for the development of New Zealand's economy through the transportation of goods and people, however little of New Zealand's formerly extensive passenger rail infrastructure remains. Competition from the private motor-vehicle during the second half of the 20th century meant rail services needed constant justification to remain in existence. As patronage levels dropped, services became less frequent or were cut. Buses replaced most local services so that today rail passenger services operate in only Auckland and Wellington. The private motor-vehicle and road infrastructure strangled the need for rail passenger and freight services.

The dominance of the private motor-vehicle in New Zealand from the 1960's, and even earlier than this in the United States and Australia, influenced urban development considerably and with ultimately negative consequences. The sustainability of the continuing global growth of private motor-vehicle ownership and use is now being seriously questioned in contemporary transport and transport related literature on a number of fronts. Cities which have grown through the dominance of private travel are now facing levels of traffic congestion which are so high it is negatively affecting the region's economy and resident's quality of life. The current global dependence on petroleum is worrying given that global oil production has peaked, meaning the previously cheap and plentiful resource is becoming increasingly valuable and less affordable. Widespread private motor-vehicle travel also contributes significantly to environmental degradation through the existence of road infrastructure and the emissions cars produce.

The (un)sustainability of growing private car use is now unanimous among many national and regional transport policy makers. Through transport research it is now understood that increasing road capacities and the speeds at which cars can travel simply encourages people to live further from the destinations they regularly access; transport planning has encouraged the dispersal of urban development. The role of public transport, and particularly of rail, is now an important tool in creating sustainable, equitable and efficient transport systems.

Passenger rail systems have been shown to be the most efficient means of transporting large numbers of people using less energy and resources and with considerably less impact on the environment than the combined use of individual vehicles. However rail systems are an expensive investment in modern societies. The cost of implementation must be justified through the potential impact it is likely to have on regional and national modal shares; simply the number of people who would use the service. Help can be provided through transport policies which encourage people to change travel behaviour by relying on public transport rather than their private motor-vehicles. Often, increasing public transport's modal share requires high quality public transport systems as well as disincentives for car use.

Rail systems are suited to high density urban corridors. Railway stations should be located in urban densities which are capable of supporting the system through maximising the number of people who use the service. The location of railway stations has been shown to increase residential and commercial development in the area. Railway systems have also been used in international settings, particularly in Germany and Sweden, as tools for influencing and planning urban development.

There is national support now for rail to increase its contribution to the national transport system. Passenger rail services are being actively developed in Auckland and modal shares maintained in Wellington. There is also recent national support for research into passenger rail for Christchurch and Hamilton (Ministry of Transport, 2005b), which is reiterated in Canterbury's 2005 Regional Land Transport Strategy.

1.2 Aims and Objectives

The overall aim of this research is to investigate the feasibility of a passenger rail service connecting the Waimakariri District to Christchurch City within the following five sub-aims:

- 1) To review the international transport literature on public transport with respect to:**
- a. What constitutes an efficient transport system;
 - b. How transport systems affect urban development;
 - c. Working towards sustainable transport systems;
 - d. Increasing public transport modal shares.

The review of international transport literature will focus on countries deemed to be part of the Organisation for Economic Co-operation and Development (OECD), in which New Zealand is included. Transport literature will focus on the United States, Australia as well as a range of European cities. These regions produce a wide range of advanced transport problems, solutions and examples.

- 2) To review national public transport policies with specific reference to rail:**
- a. What are the national transport policies;
 - b. Where public transport fits as a national transport priority;
 - c. The current and future role of rail;
 - d. Where funding for future passenger rail services would come from.

This is the second part of the transport literature review with focus on New Zealand's transport system and the policies which determine the direction of investment into the system. Transport strategies will reveal

priorities placed on individual modes of transport, including rail, and the way in which New Zealand's transport infrastructure and investment are managed.

3) To review Canterbury public transport policies and plans with specific reference to passenger rail and the Waimakariri District:

- a. What actions are being taken by local authorities;
- b. The integration of transport and urban development planning;
- c. What options there are for passenger rail in Canterbury;
- d. How much does rail cost.

The third and final part of the literature review will be through the help of resources provided by Environment Canterbury, the Christchurch City Council and through a collaborative group providing a Canterbury forum on transport and urban development known as the Greater Christchurch Urban Development Strategy. This research will be in co-operation with the Waimakariri District Council and Environment Canterbury, who will be actively researching rail options for the Canterbury region as stated in the Regional Land Transport Strategy.

4) The assessment of current rail infrastructure and public transport services for the Waimakariri District:

- a. What are current public transport services in operation and who operates them;
- b. How well utilised are these services;
- c. Are there plans to develop public transport in the area;
- d. What is the current state and use of the rail infrastructure.

This will be achieved through:

1. Attendance at a planned rail workshop discussion involving potential stakeholders in the development of passenger rail within Canterbury and current users of the infrastructure.
2. Ongoing communication with Environment Canterbury; as the primary operators and organisers of public transport for Canterbury.
3. Communication with the Christchurch City Council; as providers of public transport infrastructure. Any plans to develop passenger rail within the greater Christchurch urban area would involve research and co-operation between these two government agencies.
4. Communication with local operators who are using the existing infrastructure for private charters along with companies granted access rights. These organisations provide knowledge of the state of the infrastructure as well as current use of the lines and any resulting limitations.

5) An assessment of the potential of a passenger rail service connecting the Waimakariri District to Christchurch

- a. How many Waimakariri District residents could feasibly use a service based on their travel needs and the location of current infrastructure and the potential locations of train stations and park-and-rides;
- b. How many journeys could be provided by a combination of public transport services;
- c. How many Waimakariri residents who regularly travel into Christchurch would switch from private to public transport.

This will be done through:

1. Resident surveys, to analyse the spatial locations of Waimakariri District origins and destinations with reference to the locations of the Main North Line and the locations of potential train stations.
2. Analysis using a GIS method approach. To map residents' travel patterns and calculate the number of journeys which could be made by rail given resident's willingness to travel by passenger rail on the current infrastructure.
3. Analysis of the integration of a rail service with existing public transport services through a GIS approach, to investigate the full potential of public transport options for Waimakariri District residents.

Chapter 2:

Transport Systems

Firstly this chapter discusses the impacts of transport systems on people and the urban environment and why transport systems now need to be sustainable.

Secondly, this chapter discusses the role of public transport in contributing to contemporary transport systems.

2.1 Maintaining Accessibility and Mobility

2.11 Efficient Transport Networks

A measure of the efficiency of transport systems includes energy consumption, the actual cost of transport, (calculated in time and money), and the social equity the system provides. Efficient urban transport systems, as well as other influencing factors, have been shown to contribute to the benefit of regional and national economies through the distribution of goods and services and the ease with which the urban population can access employment and amenities (Du & Mulley, 2006; Jakob et al., 2006; van der Vooren, 2004).

Mobility and accessibility are often related but differ slightly in interpretation. For example, a person living in a remote area may spend considerable time and money to access particular destinations, meaning low access levels. However this person may be capable of travelling at high speeds on country roads meaning low time and travel costs per kilometre; which is a measure of mobility (Levine & Garb, 2002; Stopher 2004). It is therefore possible to have low accessibility levels but relatively high mobility levels. Conversely, people who live close to a range of destinations, such as in the central city, will have access to a wide range of destinations but with typically lower mobility levels due to lower travel speeds. Urban transport infrastructure has a significant impact upon resident's individual accessibility and mobility levels. The cost and speed of transport options available is therefore an important consideration in urban transport policy.

Urban areas rely on maintaining the efficiency of urban transport system for a number of reasons. Efficient transport ensures high living standards for those residing in the area by successfully combating total increases in demand for the transport network. Growing populations and the growing demand for transport places constant pressure on existing urban transport systems. In many contemporary urban settings, increasing traffic congestion is a problem that has decreased living standards and hindered economic development. For example, New Zealand and Australia have seen significant increases in urban traffic congestion within the last two decades (Newman & Kenworthy, 2001).

Mobility and accessibility are measurements of the effectiveness of a transport system. Modern transportation planning works on the derived demand notion (Levine & Garb, 2002; Salomon & Mokhtarian, 1998; Stopher, 2004) which states that people do not consume transportation simply to experience movement, rather that people "travel in order to reach opportunities available at destinations" (Levine & Garb, 2002;pg180). Modern transport systems have evolved to be dominated by the privately owned motor-vehicle and road infrastructure, to the detriment of public transportation systems. The increase in individual mobility levels as a result of mass car-ownership has resulted in the physical growth and dispersal of urban areas. While mobility levels may have risen for car-owners and decreased for those without cars, accessibility levels have dropped for everyone.

Through an understanding of mobility and accessibility a change of focus has occurred in transport policy. Transportation planners now look at how transport problems can be solved by improving accessibility rather than mobility (Bertolini et al., 2005; Levine & Garb 2002; Salomon & Mokhtarian, 1998). Alterations to the transport system which increase mobility levels while decreasing accessibility are now seen as a failure of the existing directive transport policy (Levine & Garb, 2002).

Increasing the capacity of the transport network will temporarily increase mobility and accessibility levels by decreasing the time and cost of travel per kilometre. However, the resulting mobility improvements allow homes and businesses to relocate or establish in more remote areas, possibly only accessible by car, to take advantage of the new accessibility benefits (Cervero, 2003). The relocation of destinations due to increased mobility creates the overall need for greater use of the transport system. In this case, where increases in mobility induce the dispersal of destinations, accessibility levels actually decrease in the long-run.

Induced demand or induced traffic is a direct result of increased mobility. The induced demand for travel is an increase in the frequency and distance of journeys in response to increased travel speeds (Newman & Kenworthy, 1999; Mees, 2000). Induced demand is also a product of land-use changes created by the construction of new roads (Cervero, 2003; Mees, 2000). The constant travel time budget supports the theory of induced demand. The travel time budget is the theory that people do not like to travel more than thirty minutes to reach major urban destinations, such as their place of work or education (Laird et al., 2001; Mees, 2000; Newman & Kenworthy, 1996). As transport technologies have advanced and transport speeds have increased, people are able to travel further within their travel time budget; thus increasing the distance people travel and the physical size of cities.

2.12 Transport and Urban Development

Technological advances in transportation during the 19th and 20th centuries have changed how people travel and where people live (Newman & Kenworthy, 1996). The sudden movement from public transport, in the form of trams and trains, to the private motor-vehicle has had significant impact on urban development in the latter half of the 20th century. The car represented high mobility and status; in comparison to the fixed transport lines of the trains and trams which preceded the car as the dominant form of transport before World War II.

Fixed line transport had predominantly focused on serving the city centre, where the majority of people worked and shopped (Newman & Kenworthy, 1996). Before the car, development had been concentrated around tram or train transport corridors and stations. The car allowed residential and commercial development in areas which had previously been inaccessible (Newman & Kenworthy, 1996). People were

able to live distances of up to fifty kilometres from the city (Newman & Kenworthy, 1996), where they could have larger sections and homes.

The rapid growth of motor-vehicle ownership increased mobility levels and was a catalyst in the rapid physical expansion of cities in North America, Britain, Europe, Australia and New Zealand following World War II (Mees, 2000; Newman & Kenworthy, 1996; Stopher, 1998). Phoenix in the United States and Canberra in Australia are examples of cities formed through motor-vehicle transport (Newman & Kenworthy, 1999). These cities have experienced physical expansion to the limits of car travel capacity. In 1997 people were travelling on average, three times further than people were in 1950 (WBCSD, 2001); coupled with global population increases, the transportation system provided eight times the total kilometres travelled during this period.

The motor-vehicle has decentralised the central city by making the cities' peripheral areas more attractive. People moved to the urban peripheries as the car became more affordable and built on land which was cheap and plentiful, creating low density living (Newman & Kenworthy, 1996). Low-cost land, now accessible on the outskirts of urban areas, has also provided attractive locations for commercial developments. As a result, places of employment are no longer confined to the city centre. Large shopping malls built in the suburbs have been designed to be accessed by cars and target the wealthy who live there. The houses and commercial destinations in the low-density peripheries of the city are accessible only by motor-vehicle and people living in the suburbs are reliant on their cars for mobility.

Growth in road vehicle use exceeded both population and economic growth in New Zealand and Australia during the 20th century (Laird et al., 2001). The popularity of the car combined with decentralisation of the city meant that public transport systems have been scrapped due to falling patronage levels and car driven government policies. The share of total global travel attributed to rail has decreased substantially since 1950 (WBCSD, 2001). The total share of travel by bus has also slightly decreased; although rail remains the biggest loser (WBCSD, 2001). The process of suburbanization associated with car use can be partly to blame for the decreases in public transport patronage. Large commercial developments in the suburbs have decreased the need for people to travel into the city centre, the termination point of many railway lines (Newman & Kenworthy, 1996). Also, regional and national governments saw the motor-vehicle as the future of urban development. Government policy also recognized the link between the increased mobility the motor-vehicle provided and the economic development it would foster.

Areas with high access levels attract economic and residential growth. Access could be provided by high mobility levels, proximity or a combination of both. The distribution of goods and services is also important for maintaining local economies. Access to goods and services has increased dramatically through the rise in private motor vehicle use. However the same popularity has also increased the

competition for road space. The continued efficiency of urban road networks has now become a focus for regional and national governments wishing to maintain or increase levels of mobility and accessibility in the region.

2.13 The Road Lobby

Today, the motoring industry remains an economic and politically powerful force. In the past, car production has helped develop national economies. These nations now rely on continued production. For example, 47 per cent of the global motor-vehicle fleet in 2000 was produced in Japan, Germany or the United States (Whitelegg & Haq, 2003). As national economies continue to advance in developing countries, a larger proportion of the population is able to afford motor-vehicles. For example, the current rapid increase in private motor-vehicle ownership in China is accredited to an advancing economy; where vehicle ownership is considered a symbol of reaching middle-class status and travel growth in average annual kilometres is 9.4 per cent in China compared to the global average of 4.6 per cent (WBCSD, 2001).

As well as a status symbol, the increased mobility provided by motor-vehicles works to overcome distance, providing people with a wider range of accessible destinations. Ideally, a regions transport system should be socially and spatially equitable so when transport systems are dominated by car use, social inequities exist for those who can not afford a private vehicle. In the past a car-dominated transport system has been associated with successful economies, or contributed to the success of national economies through motor-vehicle production. However car-dominated cities are now experiencing a number of capacity related problems and have begun to look at alternative modes of transport such as passenger trains to solve their problems (Newman & Kenworthy, 1999). Governments in historically car-dominated cities may have suddenly realized that the demand for private transport can not be satisfied by continually increasing road capacities.

2.14 Changing Transport Policies

In the past, the construction of new road infrastructure has been justified by increases in accessibility, reduced fuel consumption, improved safety and environmental benefits (Pfleiderer & Dietrich, 2003). There is still pressure from road lobby groups today for the increased expansion of road infrastructure. Reports written by road lobby groups quantify projected time and accident savings into projected increases in Gross Domestic Profit (The Allen Consulting Group, 2004). However, increasing road capacities in an attempt to cope with increasing car-use has drawn strong criticism in contemporary transport literature (Cervero, 2003; Laird et al., 2001; Levine & Garb, 2002; Mees, 2000; Pfleiderer & Dietrich, 2003; Stopher, 2004; Whitelegg, 2003). It is argued that growth in car-use (increased car-use combined with population growth) can not be saturated by continually increasing road capacities; rather that the building of new road infrastructure will induce longer and more frequent journeys, returning traffic congestion to similar or greater levels than before.

The consideration of induced traffic is now an important but poorly understood consideration in contemporary transport policy (Docherty & Shaw, 2003). Predicting and measuring induced traffic levels is difficult (Cervero, 2003). Major studies which have been conducted in the United States and United Kingdom have found that increased road capacities lead to an almost equal increase in vehicle kilometres travelled. Houston, which has invested billions in motorway improvements, has had some success in easing congestion (Cervero, 2003). However, the sustainability of Houston's policies may not be known for some time. What is now considered sustainable transport policy is a focus on accessibility; increasing the ease with which people can reach destinations, rather than simply increasing transport speeds by relieving traffic congestion (Bertolini et al., 2005; Laird et al., 2001; Levine & Garb, 2002; Mees, 2000). The use of alternative modes of transport is also noted as an important aspect of accessibility based policies.

Studies on the interaction between land uses and transport systems are used to identify transport systems which reduce the total amount of travel, energy and resources needed to reach important destinations (Akerman & Hojer, In Press). The new urbanist approach argues that the design of urban areas should promote ease of access to public transport and encourage alternative modes of transport such as cycling and walking (Mees, 2000). New urbanist design attempts to create urban areas which are less reliant on the private motor-vehicle.

The new urbanist approach is a response to negative aspects of suburbanization caused by reliance on the private motor-vehicle for the majority of urban transport. An example of a new urbanist policy approach is the compact city or pro density approach (Newman & Kenworthy, 1999). Advocates of an increased density approach believe that increasing urban densities in specific sections through land-use policies which concentrate population, employment and commercial activity will lead a decrease in the total amount of travel (Mees, 2000). The theory underlying density increases is an attempt to counter dispersal by creating closer origin and destination points which are more conducive to public transport services and local trips by foot or bicycle.

2.2 Sustainable Transportation

2.21 Global Trends

Sustainable development was made global policy at the 1992 United Nations Conference on Environment and Development (UNCED). The term sustainable development was defined in the 1987 Brundtland Commission as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs"(OECD, 1996;pg10). Sustainable transportation is seen as sustainable development within the transport sector (OECD, 1996). Transport consumes enormous amounts of energy and space and there is constant debate over the environmental and social benefits and

disadvantages of various regional and national transport systems. Much of the literature discussing the (un)sustainability of global mobility increase is critical of the continued growth of motor-vehicle use and production.

Mobility levels have increased rapidly during the second half of the 20th century due to rapid growth in the use of the motor-vehicle and the widespread construction of road infrastructure. The increasing global consumption of motor-vehicle use has raised sustainability issues relating to land use, traffic congestion, vehicle emissions and fuel consumption. Contemporary car-dominated systems provide examples of the negative social and environmental impacts which result from reliance on the motor-vehicle.

There is growing evidence, even from within the motoring industry, that existing global transport trends are not sustainable. There are currently over 600 million motor vehicles in use worldwide (Wikipedia, 2005). and growth in global passenger kilometers travelled, for all modes of transport, has increased on average 4.6% per capita from 1950 to 1997 (WBCSD, 2001). The production of motor vehicles continues to peak. Global passenger car production reached a record 40.9 million vehicles in 2000 (Worldwatch Institute, 2001). Current global transport trends are cause for global environmental concerns such as vehicle emissions and the resource availability of petroleum. Vehicle technology has recently improved both fuel efficiency and vehicle emissions of pollutants in new cars. However these improvements are offset by two trends: the global growth in motor-vehicle use and the widespread use of older vehicles in developing countries (WBCSD, 2001).

96 per cent of the global transportation of passengers and freight currently relies on world oil reserves. The demand for petroleum is expected to double within the next 25 years along with global transport demand (WBCSD, 2001). Current transport systems consume large amounts of finite resources such as fossil fuels and land. Oil production is expected to reach a peak within the next two decades, after which production levels will gradually decrease and oil prices will rise (Whitelegg & Haq, 2003; WBCSD, 2001). Predictions of production levels of oil after the peak are uncertain considering the volatile nature of the Middle East which holds 65 per cent of known global oil reserves.

Pollutants emitted from motor-vehicles are contributing to global warming with 23 per cent of global greenhouse gas emissions in 1997 from motor-vehicles (Akerman & Hojer, Article in Press). Carbon emissions created through the burning of fossil fuels increased 20.5 per cent from 1990 to 2003 (IEA, 2005). The majority of the increased global greenhouse gas emissions are due to the use of fossil based fuels in transport and industry. These figures reveal that the transport industry continues to grow, often faster than economic growth (Whitelegg & Haq, 2003).

Given current energy policies and transport trends, transport based emissions would increase 50 per cent between now and 2030 (IEA, 2005). The International Energy Agency (IEA) states that continued research and development of alternative fuel sources, such as hydrogen is an important step towards reducing carbon emissions from transport. Increased research and investment from the motoring industry is needed for a motoring revolution to occur. Alternative fuel technology is expensive to develop and run so while the technology exists large capital investment by motoring companies is needed to make alternative fuels a viable option.

Another global issue concerning transport is the amount of land road infrastructure consumes. Each car requires on average 200 square metres; with a global fleet of motor-vehicles in 2030 estimated to consume 200,000 square kilometres of land (Whitelegg & Haq, 2003). As discussed, the motor-vehicle encourages dispersal, increasing the amount of infrastructure needed. The amount of land taken up by road infrastructure again raises equity issues. Developments of motorways often disadvantage those of lower socio-economic status. Governments purchasing property for transport development will investigate areas which are cheap to purchase and which hold less political power.

2.22 Congested Networks

Relieving congestion by increasing road capacities is not a sustainable practice. The demand for road transport can not be saturated by the continuous construction of road infrastructure in an attempt to accommodate for the demand. As has been discussed, widening roads or building more motorways will induce more traffic and congestion to levels which people were willing to accept in the first place (Cervero, 2003; Mees, 2000; Stopher, 2004). Congestion can be seen as a way of restricting motor-vehicle transport. Congestion can also make sustainable modes of transport more attractive through time and cost savings. It can enforce charges on those using congested routes and investing this revenue into improving alternative modes.

The sustainability of transport requires a holistic approach, or what is known as a systems approach (Laird et al., 2001). A systems approach takes these five principles into account:

1. Providing more roads induces more traffic
2. Land use must co-operate with transport
3. The necessity of efficient public transport systems
4. Increased traffic speed reduces cycling and walking
5. The simple restrictions on car use (Laird et al., 2001; Mees, 2000).

2.3 Public Transport

2.31 Public versus Private Transport

The overall efficiency of mass public transport compared to individual or private transport is an important consideration for the future sustainability of urban transport networks. Public transport is capable of shifting more people, using less natural resource and causing less environmental degradation (Akerman & Hojer, 2005).

Public transport can be defined as a transport service which uses high occupancy vehicles, such as trains and buses, on fixed lines or routes. Public transport services are now regarded in transport literature as important for providing an equitable and sustainable transport system (Stradling, 2002). On a basic level, public transport is looked at as a solution to the negative externalities of car travel such as congestion and environmental degradation.

As discussed, the current use and growth of motor-vehicle use is not sustainable. Efficient public transport systems are capable of transporting large volumes of people, subsequently using less energy and resources than the combined individual use of motor-vehicles. For example the use of electricity for powering rail services decreases human dependence on petroleum and also decreases overall carbon dioxide emissions (Laird et al., 2001). With demand for transport increasing globally, the role of public transport systems is becoming increasingly important.

2.32 Successful Public Transport

It is the dispersal of origins and destinations in suburban areas that makes providing adequate public transport so difficult (Laird et al., 2001; Mees 2000). There is a range of population densities provided as the minimum needed to support a public transport system. Density levels can determine the viability of operating a transport service. Urban densities can also dictate the mode of public transport used. Previous studies providing minimum population density thresholds have proved entirely contextual (Mees, 2000). Modal share resulting from various levels of service affects low range density thresholds. A high quality service which attracts a 20 per cent modal share will require lower urban densities than a service with 10 per cent modal share. Government subsidies can also determine patronage levels required to justify a service. Depending on modal share and government subsidies, minimum urban densities required can range from 14 to 92 people per hectare (Mees, 2000). Services must rely on patronage or a combination of patronage and government subsidies to cover capital investment and operating costs. A utopian, ultra efficient integrated network of services supported by high modal share and population densities would require zero subsidies. Decreases of modal share would then need to be balanced by increase population densities or government subsidies.

There have been some solutions offered and examples provided for tackling the problem of dispersed populations. The efficiency of such systems is paramount. Services need to be flexible; that is the provision of a service with a wide range of origins and destinations. For example buses are capable of flexibility yet are let down by low travel speeds and indirect routes, while rail can attain high speeds but does not offer flexibility on its own. A well planned and integrated combination of modes is needed to provide as comprehensive a service as possible (Mees, 2000). The cost of travel is also an important consideration. Affordable public transport has proven successful in attracting patrons (Fitzroy & Smith, 1995).

The Zurich model is used as an example of a successful public transport system which captures a substantial proportion of all travel (Mees 2000). The Zurich model uses a well organized grid network to increase the amount of people the service is available to. The success of the Zurich system is in the opportunity for passengers to transfer between reliable services quickly and easily; the organisation of the integration between modes is seamless. Buses feed waiting high speed rail services, forming a 'pulse' network capturing on average "500 trips per resident per year" (Mees 2000;pg124). Zurich's public transport patronage levels are second only to Hong Kong and are attributable to decades of integrated transport policy through the establishment of a central planning agency (Mees 2000).

Another example of successful public transport is found in Freiburg, Germany. Freiburg has a population of around 250 000 people. Public transport systems consist of bus and tram networks. The extension of services in Freiburg made public transport available to a large proportion of the population from 1982-1992 (Fitzroy & Smith, 1995). Increases in service frequencies raised the quality of the service. The introduction of affordable monthly passes, which allow unlimited travel on all services during the month made public transport affordable. Disincentives for car users such as low-speed-zones, high parking charges and pedestrian friendly urban planning increased the attractiveness of public transport (Fitzroy & Smith, 1995). The success of Freiburg's transport policies makes it one of the most efficient transport systems in the world. At 18% public transport modal share in 1992, Freiburg is lower than Zurich's 37% due to the amount of journeys made by bicycle (Fitzroy & Smith, 1995).

The importance of coordinated planning agencies and policies is crucial for the organization, reliability and success of any public transport system. Generally, people do not like to wait more than 10 minutes for their service to arrive (Jefferson, 1996). Transport literature also states that people will avoid transferring between modes if they are waiting more than 10 minutes for the connection. Headways are known as the frequencies a service runs and if public transport service headways on a connecting service are over 10 minutes, the services must be timed to instantly connect with the waiting service. The mechanics of transferring should be quick and simple. Pre-payment of fares is ideal (Jefferson, 1996). Waiting points should ideally be sheltered, well lit, safely accessible by foot and have adequate and clearly displayed information about the service.

Hours of operation and subsequent frequencies help determine demand for a service. An all day, high frequency service can induce demand for travel on the service (Jefferson, 1996; Mees 2000). A high level of service creates sustained levels of patronage compared to services with frequencies that decrease and become irregular during off-peak operation. A consistent and reliable frequency which operates from 7am-12am encourages off-peak journeys (Mees 2000), an important factor in the service being economically viable.

Population and job densities are important considerations when investing in public transport, as is a regions physical landscape. Different types of public transport suit particular areas and can solve a particular regions transport problems. Public transport can be successful at servicing high density areas such as central cities, where access by private vehicles may be low (Hensher 1998). Public transport systems work best when serving high-density corridors. However many cities have sprawled out over large amounts of land and there are obstacles to establishing and running a public transport system catering for dispersed populations with dispersed travel origins and destinations (Newman & Kenworthy, 1996; Mees, 2000). For public transport to be energy and economically efficient, the services must capture a significant proportion of all travel. Transport modes chosen must reflect the urban setting. A combination of different modes may be used to provide variable urban settings with an efficient service.

Literature on public transport compares and critiques the various transport modes available and used by different cities (Brand & Preston, 2003; Hensher, 1998; Mackett & Edwards, 1998). Ultimately the correct mode of choice is entirely contextual. There is cost and efficiency comparisons between different modes used in public transport systems. The options range in cost from underground metro lines such as those in Paris and London to priority Bus-ways as seen in Ottawa and Curitiba. Bus-ways can operate on guided tracks not dissimilar to rail but are characteristically less expensive to create or simply a bus service running on priority road space. Capacities of mass-transit modes can vary depending on demand and infrastructure. Bus-ways such as that operating in Curitiba on guided rails have been shown to have the capacity to transport between 10,000 and 20,000 passengers in one direction during peak hour (Brand & Preston, 2003); capacity levels comparable to light rail. Underground metro systems exhibit the limit of upper capacity figures, ranging from 40,000 to 70,000 per hour (Brand & Preston 2003; Edwards & Mackett, 1996). Metro however is the most expensive investment mass transit option and must therefore be supported by high population densities.

Rail has been proven to be successful when servicing high density transport corridors while the flexibility of the bus is more suited to low-density suburbs (Mees, 2000). However some of the most successful transport systems have carefully integrated the use of bus and light rail to ensure maximum patronage (Mees, 2000). Well organized bus routes servicing a high frequency, high speed rail service has proved

successful in Zurich, Germany. The success of the Zurich system relies on: integrated planning and co-ordination of services, seamless transfers between modes, high frequencies of both feeder buses and rail service, and restrictions on car use (Mees, 2000). As noted previously, Freiburg has now established successful public transport system which captured 18% of all travel by 1992 (Fitzroy & Smith, 1998). Freiburg also boasts a significant proportion of journeys by bicycle due to the development of an extensive cycle-way system (Fitzroy & Smith, 1998). The availability of affordable, high quality public transport in Freiburg combined with disincentives aimed at car users (Fitzroy & Smith, 1998) has made it one of the most equitable transport systems in the world.

Capturing and retaining patronage is an important consideration for public transport operators. The literature states that public transport systems must be high frequency, (Mees, 2000; Wardman et al., 2004), reliable, (Anable & Gatersleben, 2005; Bates et al., 2001; Stradling, 2002) and affordable, for people to consider switching from private to public transport. The speed of travel is also a factor in determining travel choice. If public transport runs at equal to or below than half the average speed of cars covering the same trip distance, people will not use modes alternative to their car. Travel time increases were a major concern when people were asked about switching to public transport (Curtis, 1997). Public transport systems operating separate from the road network are capable of operating higher average speeds. Busways in Ottawa average 50km/h when unimpeded, compared to 23km/h when mixing with traffic (Brand & Preston, 2003). Bus services that mix with traffic are severely hindered by congestion because they are constantly pulling in and out of bus stops. Bus lane initiatives are necessary in busy urban corridors (Eichler & Daganzo, 2005). There is also evidence to suggest that buses increase traffic congestion on busy two-lane roads (Nagai et al., 2005) which is one of the reasons bus lanes are being used in many international settings.

2.33 Public Transport as a Tool

International literature explains that public transport is a necessity for the sustainability of urban development (Bertolini et al., 2005; Priemus et al., 2001). Urban sprawl caused by widespread dependence on the private motor-vehicle is now seen as a major obstacle for any public transport services conducive to sustainable transportation. Cities formed through the rapid growth of private transport are now investing in a range of public transport options in an attempt to solve growing transport problems such as congestion and environmental degradation (Bonnell, 1995). Smaller developing cities such as Christchurch, New Zealand now have the opportunity of developing efficient alternative modes of transport sooner rather than later to avoid the problems of cities which now cover large amounts of land with low density suburbs. Contemporary transport policy can learn from the mistakes of existing sprawling cities, and the problems they now face. Foresight used in the integration of land use and public transport systems can save local bodies and national governments time and money in the future.

Shifting the proportion of travel from private to public transport can be difficult because many people view car access as a necessity (Kingham et al., 2001). Many people's use of their private motor-vehicle is ingrained into their everyday life and these people may make a variety of trips and destinations during the day. The motor-vehicle represents mobility, control, comfort and status, especially among young adults. In contrast, public transport has been associated with a lack of control, freedom or independence (Anable & Gatersleben, 2005). An increased sense of control over proceedings of a journey can be achieved through reliability of the service (Bates et al., 2001). The efficient organisation of public transport systems is therefore an important determinant of patronage levels (Mees, 2000). People must have reasonable access to the transport and trust the reliability of the service for planning their journey, especially for the commute to work.

The introduction of public transport systems such as suburban rail is often to solve congestion and reduce dependence on petroleum created by widespread individual car use. Congestion and pollution are becoming global transport issues and the energy efficiency of urban transport is becoming an increasingly important consideration. There are obviously going to be challenges in establishing a successful public transport system that must cater immediately to societies reliant on cars. A comprehensive integrated transport policy with a combination of efficient public transport modes and options (Laird et al., 2001; Mees, 2000) is capable of capturing a significant proportion of urban travel as shown by German cities Freiburg and Zurich. As is the case in Zurich and Freiburg, all modes of transport are considered part of an integrated transport network in transport policy which makes for an efficient and equitable urban network.

2.34 Evaluating Rail

Rail has come into favour by regional and national governments because of its capabilities of increasing the attractiveness and quality of urban public transport (Du & Mulley, 2006), thereby contributing to a sustainable and efficient transport network. Rail is still the most energy efficient transport mode for the movement of freight and passengers (Ministry of Transport, 2005b), and is capable of transporting large numbers of people at high speeds. Rail systems are generally implemented when urban populations and car dependence levels congest transport networks and decrease standards of living. Implementing new rail systems into dispersed urban environments can initially be difficult; however the long term benefits are permanent.

The benefits of rail are in the fixed nature of the mode. Rail systems have been shown to increase land value around train stations due to the increased levels of accessibility to the area (Du & Malley, 2006) and are highly visible and capable of high speeds. It is stated in transport literature that one of the benefits of suburban rail is that it is a radical, high profile alternative to the private motor-vehicle (Newman & Kenworthy, 1996; Mees, 2000). Other benefits of rail travel include comfort and reliability (Jefferson, 1996). Electrified rail systems can provide increased environmental benefits such as low emissions, noise

and vibrations while the fixed nature of rail has been shown to increase pedestrian and passenger safety due to its high visibility and predictable travel path (Jefferson, 1996). Rail platforms also provide the opportunity for level access to the train carriages, which when combined with automated ticketing, decreases the time spent stationary and increases average travel speeds (Jefferson, 1996). The separation of rail and guided Bus-ways from the road network negates delays caused by congestion or negotiating in and out of traffic at stops. Average travel speeds by bus without the availability of priority space will remain around half the average speed of travel by car while priority bus space can significantly increase average travel speeds.

Research has shown railway stations are capable of attracting residential and commercial development resulting in high density nodes (Edwards & Mackett, 1996; Gibbons & Machin, 2005). Urban development can be planned around the location of stations. Suburban rail can also co-operate with the movement of regional and national freight and increasing rail transport capacities can be achieved through additional carriages. If, as is proposed, public transport increases its proportional share of all travel, increasing capacities should be an important future consideration in the development of any service. The formation of railway station hubs is important as it represents less dependence on private motor-vehicles in the area.

Importantly, rail is renowned for being a potentially reliable form of transport. Reliability is an important consideration in ensuring the success of any public transport system (Anable & Gatersleben, 2005). People enjoy driving because they feel they are in control of their travel. Therefore the accuracy of transport timetables is important in allowing people to control their travel by not having to wait stationary for long periods of time or be subject to in-travel delays on the system.

Chapter Three:

Land Transport in

New Zealand

*This chapter firstly discusses public transport with
reference to passenger rail for New Zealand,
Canterbury.*

*Secondly, introduces the study area: the
Waimakariri District with specific reference to
current transport issues.*

3.1 The State of Public Transport

3.11 New Zealand's Public Transport History

New Zealand has a proud history of travel by way of train and tram between and in urban settlements. New Zealand's first railway line was opened in 1862 for mining purposes near Nelson. Rail was dominant in the South Island and by 1880 there was a line running from North Canterbury to the island's southern point, Bluff. This line linked Bluff, Invercargill, Christchurch and Lyttelton and formed the trunk line of the South Island. Railway building peaked in the 1870's and 1880's with lines connecting Lyttelton and Christchurch to Rolleston, Methven, Arthur's Pass, Ambereley and Little River among others (Map of Lines, SCAN). By 1880 New Zealand had one mile of railway per 460 people, among the highest proportion in the world at the time. In comparison, England, the home of rail, boasted one mile per 2000 people (Leitch, 1972). The construction of rail in the North Island was the catalyst for accelerated settlements. In this early period rail provided opportunity for development rather than connecting existing settlements so it wasn't until 1914 that a trunk line ran from Wellington to Auckland (Leitch, 1972).

Urban transportation in New Zealand cities was impressive in the early 1900's. Electrified rail is seen in contemporary public transport circles as the pinnacle of modern public transport, yet by 1916 New Zealand boasted electric tram systems in Gisborne, Napier, New Plymouth and Wanganui as well as Auckland, Wellington, Christchurch and Dunedin (Laird et al., 2001). At this early stage cars were not widely available and electric trams were the popular form of urban transport (Laird et al., 2001). New Zealand cities are therefore influenced greatly by tram routes and should be conducive to a return to what was an efficient mode of transport. International cities used rail to extend overcrowded cities and connect essential industries to ports. History has shown that rail was, and still is, the most effective tool for mass transit (Laird et al., 2001).

Railway construction reached its passenger volume peak by 1953. Rail connected all major urban settlements and also provided popular urban transport within the main centres. The 1950s saw a movement away from trains and trams to buses and coaches. Trams were removed from all of New Zealand's major cities from 1950-1957 (Graham, 1996), to make way for cars and buses. Many tram routes provided direct routes to train stations which assisted in the trains declining patronage. Inter-urban train travel remained popular for the next two decades, although rail stock deteriorated quickly and the existence of many services was constantly in question.

The decline of rail from 1955 was a combination of falling patronage, ageing infrastructure and stock, government policy, and bad luck (Miles, 1995). A fleet of 35 railcars purchased for the Northland region between 1955 and 1959 proved too vulnerable for New Zealand's harsh railway environment and were never replaced due to declining patronage on all services (Miles, 1995). Government policy concerning the railways saw road coaches favoured over the \$2 million investment required to purchase new railcar

engines (Miles, 1995). It was argued at the time that road coaches could provide replacement services at a lower capital cost. The coach services could also be run at lower operating costs. The high capital investments involved in replacing train stock meant buses replaced many services. On March 25 1976 it was announced that “replacement rail rolling stock which would have to be fully imported would cost well over \$22 million, but new buses to replace railcars, from New Zealand manufacturers could be obtained for under \$3.5 million”(Miles, 1995;pg28). The decision met much nationwide resistance, yet this policy decision signalled the end of the majority of New Zealand’s rail passenger services.

New Zealand rail was privatised in 1993. The government owned New Zealand Rail Limited was purchased from the New Zealand government for \$400 million (New Zealand dollars) by international buyers who adopted the name Tranz Rail. In 2001 the government repurchased Auckland’s rail infrastructure from Tranz Rail, whose financial state had deteriorated along with some of the rail infrastructure, in particular the Midland Line between the West Coast of the South Island and Lyttelton. In 2004 the rest of New Zealand’s rail infrastructure was purchased by the government under with the help of Toll Holdings, now known as Toll NZ. As part of an agreement, Toll Holdings agreed to sell the rail infrastructure back to the New Zealand government. The purchase of the national rail network was needed to secure an important aspect of transport infrastructure for a common national interest according to the 2005 National Rail Strategy (Ministry of Transport, 2005b), where it is stated that the current New Zealand government now recognises the importance of rail as part of New Zealand’s transport infrastructure in contributing to the visions of the New Zealand’s Transport Strategy.

3.12 Current National Land Transport Strategies

Land Transport New Zealand (LTNZ) is the Crown entity responsible for allocating land transport funding. LTNZ implements government policy and interacts with regional councils and territorial authorities as well as ONTRACK who are responsible for managing the rail network (see figure 3.1). The main activity of LTNZ is to allocate government transport expenditure, which was \$1.8 billion for the 2005/06 budget with an extra \$87 million expected to be added (LTNZ, 2005). The allocation of funding is displayed in table 3.1

Table 3.1 Land Transport New Zealand funding allocations

Allocation	Funding (million)	Local Government Rates (million)
State Highways	\$941	
Walking & Cycling	\$7	\$3
Rail & Sea freight	\$10	\$5
Regional development	\$15	
Passenger Transport	\$251	\$156
Local roads	\$481	\$387
Administration	\$73	\$6
Research, education & training	\$5	

Source: Adapted from LTNZ, (2005).

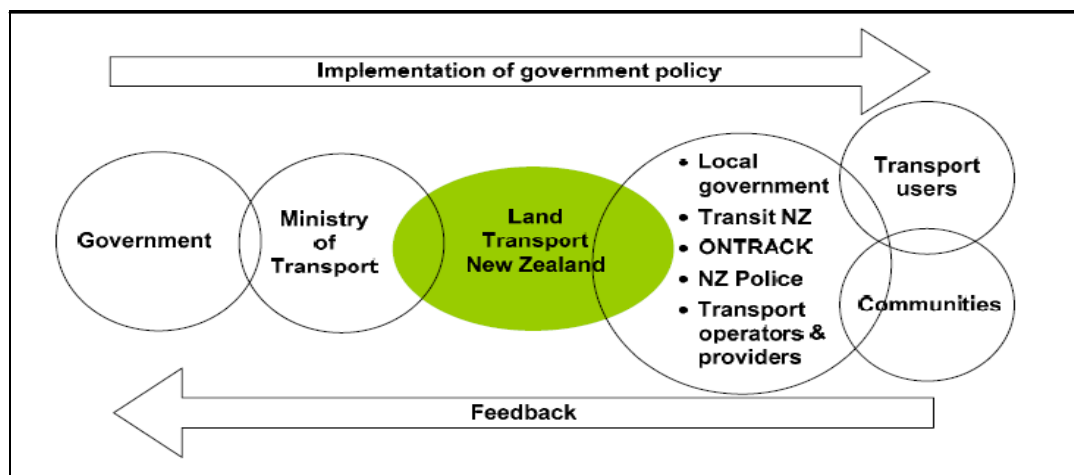


Figure 3.1 Structure of New Zealand's transport sector

Source: LTNZ, 2005

Funding for regional transport comes from a variety of sources. \$1.5 billion is allocated towards national projects that are judged to have nation-wide benefits, while \$200 million is distributed amongst regions based on population. An additional crown fund of around \$60 million is allocated for specific projects in various regions, such as \$65 million between 2005/06 and 2014/15 to maintain passenger rail modal share in Wellington (LTNZ, 2005). There is also regional funding raised through regional-territorial and council rates. A total of around \$550 million was allocated towards land transport from regional rates during 2005 (LTNZ, 2005).

New Zealand's current National Transport Strategy (NZTS) was presented in December 2002 by then Minister of Transport, Paul Swain. The strategy sets a goal year of 2010 for the visions set out in the statement. A clear objective stated in the 2002 NZTS is to "return New Zealand's per capita income to the top half of the OECD and maintain that standing" (Ministry of Transport, 2002;pg 3). The link between efficient transport systems and the economy is clearly acknowledged. The now widely recognized vision statement of the NZTS is that "by 2010 New Zealand will have an affordable, integrated, safe, responsive, and sustainable transport system" (Ministry of Transport, 2002;pg 2). This statement vision has been created through the four principles of sustainability, integration, safety and responsiveness and includes five clear objectives being:

- To assist economic development
- To assist safety and personal security
- To improve access and mobility
- To protect and promote public health
- To ensure environmental sustainability (Ministry of Transport, 2002)

The sustainability of New Zealand's transport is based on looking at future outcomes of decisions made in the present by taking into account "the needs of future generations" (Ministry of Transport, 2002;pg 2). Integrated transport within the NZTS refers to the need for a combination of transport modes in the transport network and the co-operation of stakeholders in transport management, while responsiveness refers to co-operation between regional and national government in ensuring all those affected by transport have input into the formulation of transport policies.

The NZTS states that "the integration of walking and cycling and public transport services has an important role to play in creating the quality urban environment" (Ministry of Transport, 2002;pg 11). Negative impacts associated with the growth of motor-vehicle use such as noise and air pollution, and transport related waste, are acknowledged. The NZTS supports public transport as a tool for reducing these negative impacts in conjunction with an increase in cycling and walking and a reduction in travel needs through urban planning and the increasing ability for people to work from home.

The NZTS provides the framework from which regional strategies are to be developed by regional councils. The environmental benefits of rail are acknowledged in the NZTS; however it states that "future increases in the use of rail to carry people and products will be determined largely by the cost and level of service relative to other modes" (Ministry of Transport, 2002;pg 7).

3.13 National Rail Strategy

The National Rail Strategy to 2015 (NRS) released by the Minister of Transport in 2005 reveals that rail has risen as a transport priority for New Zealand.

The NRS recognises the importance of rail in moving people out of their cars for urban journeys and in utilising rail for the movement of freight (Ministry of Transport, 2005b). It is stated in the NRS that passenger rail services will concentrate on busy urban corridors in New Zealand's main centres to target increasing levels of congestion (Ministry of Transport, 2005b). Passenger rail services currently exist in Auckland and Wellington and there is current interest and research for the establishment of passenger rail services for Christchurch (Canterbury) and Hamilton (Ministry of Transport, 2005b). Land Transport New Zealand (LTNZ) states that funding for the implementation of passenger rail services for Christchurch and Hamilton would be a consideration. The large initial capital investment rail requires can be a difficult hurdle. Large capital investment for new passenger rail services in Christchurch or Hamilton would need to come from LTNZ in the form of national, regional or crown distributed funds, possibly in conjunction with regional and private contributions. Funding co-operation between regional councils, raised from rates, and LTNZ subsidies for passenger rail, currently occurs in the operation of services in Auckland and Wellington (Ministry of Transport, 2005b).

The national government now recognises the increased capabilities of rail for moving large amounts of people and using considerably less energy and resources than the individual use of private motor-vehicles. The NRS states that \$200 million will be invested in rail during this time to meet objectives which replicate those stated in the NZTS, with emphasis on encouraging passenger and freight modal shifts from car and truck to rail (Ministry of Transport, 2005b). While the NRS works in conjunction with the NZTS, since release of the NZTS the government has realised the importance of rail and the need for investment in the countries rail networks. The NRS emphasises this need for rail to provide a greater contribution to New Zealand's transport system.

3.13 The Cost of Transport in New Zealand

People pay direct and indirect costs as a direct result of travel. Walking excluded, transport incurs direct and indirect costs which are borne by the person travelling, and by society. An example of a direct cost is someone travelling by car paying for petrol or diesel on a per kilometre basis. Vehicle purchase, vehicle maintenance, travel time and damage repairs are also examples of direct costs met by the user (Ministry of Transport, 2005a). Car users also pay charges to national and regional agencies for use of the road infrastructure in the form of car registration, fuel taxes, and simple forms of road charging, such as tolls and parking charges. Revenue sources have been shown to come from a variety of user charges in what is known as a fully allocated cost (FAC) approach to the pricing of road infrastructure, which is a widely used approach to costing (Ministry of Transport, 2005a). However the efficiency and accuracy of the FAC

approach is questionable considering the source of some revenues; those from home owner rates are system wide averages which do not reflect the higher costs imposed on society by heavy users (Ministry of Transport, 2005a). True transport costing takes into account the amount of individual use and the impacts this use has on the environment and other people. Assessing the different modes of transport separately enables an evaluation of the true costs of travel.

Urban road pricing is commonly seen as a measure in reducing urban traffic congestion (Ison, 2000; Viegas, 2001). However, increased capability for monitoring the road network has also promoted highly accurate road pricing into many international settings to more accurately represent the direct and indirect costs associated with transport. In attempts to control congestion, electronic road user charging or urban transport pricing (UTP) is capable of increasing the efficiency and equity of the transport system if revenue is used to improve alternative modes of transport (Ison, 2000). For UTP to be equitable, public transport must access the areas of high demand, such as the city centre, and be affordable (Viegas, 2001). For example, the London central city congestion tax scheme benefits those willing to pay the five pound charge by saving them time. People who do not wish to pay the charge can also benefit from alternative transport options available which are cheaper and more efficient. People switching to, or currently using, bus services therefore also benefit from less inner city congestion (Santos & Bhakar, 2006). By charging road users for contested road space, UTP is more likely to reflect the real cost of travel.

The objectives of urban road pricing should be to improve the transport system for everyone. Reducing congestion means shifting trips to alternative modes, alternative times or canceling trips entirely (Viegas, 2001). Road pricing policies should not focus solely on economic objectives (Viegas, 2001), but also look to invest generated revenue into more sustainable, equitable and energy efficient transport options such as mass-transit public transport, cycling and walking. The future of road pricing is to charge per vehicle per kilometre, depending on the traffic volume, or demand of a route or area, with the objective of people contributing to the true cost of transport by internalising the indirect costs associated with travel. With demand for transport increasing, road pricing allows regional authorities to control and regulate all aspects of the transport network.

The term externalities is an economics based term used to describe “costs that are borne by people other than those creating them” (Mees, 2000; pg23). Air and water pollution caused by motor-vehicles is an external cost because everyone feels the effects, or pays for it, regardless of whether they drive a vehicle. Although traffic congestion only impacts upon a select group of people it is still considered an external effect mainly due to the fact that congestion is a phenomenon which is created by a large number of people and is beyond the control of the individual. Individuals rarely consider the impacts of their actions in contributing to traffic congestion. A clear external cost created by traffic congestion is when public

transport services using the road system are delayed; in this case traffic congestion negatively affects those who are not actually contributing to the congestion.

A comprehensive study recently conducted by international management consultancy firm Booz Allen Hamilton on behalf of the New Zealand Ministry of Transport attempted to evaluate how much users of the road and rail system pay through direct costs compared to the costs these modes impose on society (Ministry of Transport, 2005a). The Booz Allen Hamilton study quantified externalities, such as the amount of carbon dioxide emissions from vehicles; valued at \$25/ tonne, the upper range of the forecast Kyoto commitment (Ministry of Transport, 2005a). Externalities in the form of environmental impacts which were also quantified include: local air quality, water quality and noise pollution. The economic impact of congestion was considerable for New Zealand's economy, costing New Zealand \$1 billion per year in 2001/2002 (Ministry of Transport, 2005a).

The purpose of this type of study is to provide policy makers with accurate information for future transport strategies. The Ministry of Transport's *Surface Transport Costs and Charges* (STCC) study concluded (see Table 3.2) that New Zealand residents were significantly underpaying for all modes of transport (Ministry of Transport, 2005a). Road transport was the worst performing mode with car-users paying directly 64% of total costs. Buses directly paid 68% with trucks at 56%. Rail transport performed slightly better at 77%, with indications that improvement in off-peak patronage could significantly improve this discrepancy. The 2005 New Zealand National Rail Strategy (NRS) can be seen as a response to the STCC findings.

Table 3.2 Summary of Surface Transport Costs and Charges main findings

Mode	Users Contribution to Total Combined Costs
Cars	64%
Trucks	56%
Buses	68%
Rail	77%

Source: Adapted from STCC (Ministry of Transport 2005b)

3.2 Canterbury

3.21 The Greater Christchurch Urban Development Strategy

The Greater Christchurch Urban Development Strategy (UDS) is a collaboration of the Christchurch City Council, Canterbury Regional Council, Transit New Zealand and the Waimakariri, Selwyn and Banks Peninsula District Councils. The UDS considers options for Christchurch's growing population. Four options are discussed in the UDS based on the development of extra housing for an increased population of

120 000 people by 2041 (UDS, 2005). The options provide suggestions for the location of the housing needed to accommodate growth and the impacts this development will have on the transport system, natural landscape and provision of services. Transport considerations for each option include predicted congestion levels and considerations for walking, cycling and public transport.

The options consider a range of housing densities as a result of residential zoning. The Business as Usual Option (BAU) looks at current trends of development. 79% of new housing would be in the form of new subdivisions in the BAU option. Residential development would continue to disperse across Canterbury increasing congestion by 320% by 2041. It would cost \$2 billion to increase road capacities to avoid estimated traffic congestion increases (UDS, 2005). Increased dispersal also increases car dependence and decreases the attractiveness of alternative transport modes such as cycling, walking and public transport. Dispersal also places pressure on water demand and natural landscapes such as the Christchurch Port Hills (CCC, 2005).

Option A (see figure 3.2) places only 40% of new housing in new subdivisions. The remaining 60% of new housing would be in the form of urban renewal within Christchurch. The concentration of development gives a 190% increase in congestion by 2041 which would cost \$430 million to mitigate (UDS, 2005). Option B offers 38% urban renewal in Christchurch as well as outlying towns and urban areas. This option is more conducive to public transport and cycling although traffic congestion would cost \$2 billion to mitigate. Option C (see figure 3.3) provides the worst case scenario of urban sprawl with 90% of new housing in new subdivisions and only 10% urban renewal. Congestion would increase by 630% by 2041. Option C is also not conducive to modes alternative to the private vehicle (UDS, 2005).



Figure 3.2: Urban Development Strategy Option A: Consolidated

Source: Available from: <[http:// www.greaterchristchurch.org.New Zealand](http://www.greaterchristchurch.org.New Zealand)>



Figure 3.3: Urban Development Strategy Option C: Dispersed

Source: Available from: <[http:// www.greaterchristchurch.org.New Zealand](http://www.greaterchristchurch.org.New Zealand)>

In response to the options provided in the UDS the public responded with 3200 submissions. 63 per cent of public submissions preferred Option A. 22 per cent preferred Option B, while only 2 per cent and 3 per cent preferred Option C and the BAU scenario respectively (UDS, 2005). The remaining 10 per cent of submitters opted for a combination of options or recommended the inclusion of an extra option (UDS, 2005). A common theme raised through public submissions from all regions was the need for passenger rail services on identified existing rail corridors between Rangiora, Kaiapoi, Rolleston, Lincoln, Lyttelton and Christchurch in the future (UDS, 2005). Allowing dispersal of the population through development increases demand for transport, in particular road transport. Providing public transport for dispersed populations is also difficult (UDS, 2005). Preserving space for natural reserves and protecting natural features is also important. Urban renewal can be effective in increasing urban densities and decreasing distances between resident's origins and destinations. Innovative, well designed urban renewal schemes can also make walking and cycling to destinations practical and safe.

3.22 Existing Public Transport Services and Infrastructure

Canterbury urban passenger transport services are run by Environment Canterbury (ECan). The 2001 Regional Passenger Transport Plan (RPTP) states the goals of passenger transport for Canterbury (ECan, 2001). The RLTS also produced by ECan aims to increase the proportion of all trips made by public transport to 6% by 2011 which. According to the RPTP this target should be 30% completed by 2006 (ECan, 2001).

Public transport is promoted as environmentally friendly and has impacts on traffic congestion and pollution (ECan, 2001). Currently, public transport refers to Christchurch's high quality bus system which has seen rising patronage figures since 1998-99 (ECan, 2001). Buses operate on radial and orbital routes around Christchurch. The recent introduction of electronic ticketing and real time information make Christchurch's bus system one of the best in the world. The implementation of high frequency orbital services such as the Orbiter and the Metrostar has been highly successful in increasing total patronage within the last 5 years. Patronage is forecast to reach almost 20 million by 2008 (ECan, 2001). This level of patronage will require serious investment into the current bus system with the possibility of the introduction of passenger rail for the region by 2008. Current bus services mix with road traffic on all routes. Increasing traffic congestion would have serious impact on the efficiency, reliability and overall quality of bus services. The introduction of extended bus lanes on Christchurch's busiest arteries would be necessary (SKM, 2004). Christchurch's bus depot located in the central business district is also near capacity and would need to be expanded and possibly relocated. Bus priority on the streets surrounding the depot would decrease travel time significantly (SKM, 2004).

Canterbury's rail network comprises three main lines; the Main North Line, the Main South Line and the Midland Line (see figure 3.6). All lines meet, or terminate at the Christchurch Railway Station, located in

Addington. The Main North Line travels through the Waimakariri District. The Main South Line connects to Lyttelton and the Midland Line to Rolleston. The Main North Line currently services around 7 freight and one passenger trains per day in each direction. The Main South line has 7 freight trains in each direction per day while the Midland Line has 12 freight and one passenger trains per day. This amount of rail activity makes Addington Station one of the busiest in New Zealand.

The existing rail lines have varying signalling systems. The Main North Line uses Central Train Control as far north as Belfast and then reverts to Track Warrant through the Waimakariri District. Track Warrant means only one train can use this section of the track at any time, limiting the capacity for additional activity on the line. The Main South Line has sections of single track but has an automatic signalling system which allows for closer spacing of trains. A large section of line from Heathcote to Hornby is double tracked and has automatic signalling, allowing for high carrying capacities.

An important function of Canterbury's rail network is the movement of coal from the West Coast. As well as additional freight movement, daily passenger services to known as the Tranz-Alpine and the Tranz-Scenic travel to Greymouth and Picton respectively. These services are predominantly tourist based.

3.23 Regional Land Transport Strategies

Environment Canterbury (ECan) is responsible for preparing Canterbury's Regional Land Transport Strategy (RLTS). Regional transport strategies are prepared in accordance with The Land Transport Act 1998 and adhere to the objectives of the NZTS. The recently produced RLTS 2005-2015 states that by 2025 transport will provide "the best possible quality of life" for residents of the region (ECan, 2005;pg2). To ensure transport systems support this vision the RLTS gives a list of the ways living standards can be maximized through efficient transport.

Congestion in Canterbury is becoming an increasingly important issue threatening the regions standard of living. The RLTS states that "by 2011, Christchurch can expect a threefold increase in congestion on the roads from 1996 levels unless significant improvements are made to the transport system and demand can be managed" (ECan, 2005;pg 1). This means improving the proportion of trips made by walking, cycling and public transport (ECan, 2005).

Rail, as an alternative mode, is mentioned as an important part of the regional transport network with its capacity to reduce road dependence and decrease the environmental impacts of road use (ECan, 2005). The 2002 RLTS to 2007 stated that a major project to be completed by 2006 was to "investigate the use of rail for commuter travel within greater Christchurch, including links to Kaiapoi, Rangiora, Rolleston, Lyttelton and beyond" (ECan, 2002;pg 24). Investigation has since included a rail workshop in April 2005, hosted by Environment Canterbury, which led to the commission of a costing report undertaken by GHD detailing

the costs of the passenger rail options identified in the workshop. Summaries of the report can be found in section 3.2. Investigations into rail for Canterbury are replicated in the 2005 RLTS which also states that the protection of existing rail corridors and infrastructure, protection of land close to stations for park and ride facilities, and integration with other transport is required to develop rail and increase the efficiency and sustainability of the regional transport system (ECan, 2005).

The Strategy acknowledges that motor vehicle transport will remain the dominant mode of transport. There is also acknowledgement that road infrastructure needs to provide space for walking, cycling or public transport (ECan, 2005). The strategy also recognises that travel behaviour, such as reliance on private vehicles, needs to be changed to increase the efficiency and equity of the region's transport system. The implementation of increased parking charges and research into road pricing is aimed at matching the cost of driving with increasing demand. Travel behaviour can also be influenced by land-use. Simply, reducing the need to travel can be achieved through integration of land-use and transport planning. The RLTS therefore works in co-operation with the objectives of the Greater Christchurch UDS (ECan, 2005).

3.3 The Waimakariri District

3.31 Description of Study Area

The Waimakariri District is the district immediately north of Christchurch City in the South Island of New Zealand with a population recorded in the 2001 Census of 36, 900 (Statistics NZ, 2001). Population growth in the study area is high with 40% predicted population growth between 2001 and 2021 (Statistics New Zealand, 2001). The Waimakariri District has as its boundaries; Pegasus Bay coastline on the East, the Puketeraki Ranges in the West, the Waimakariri River providing the boundary between Christchurch City and the Waimakariri District in the South, with a less well defined boundary to the North of the Ashley River where the Waimakariri District meets the Hurunui District (see figure 3.4). Christchurch is shown by the large grey area to the south. The major urban areas located within the Waimakariri District are Kaiapoi (9,258 people) and Rangiora (10,800 people) which are linked to Christchurch through two road bridges and one rail bridge which cross the Waimakariri River. The population density for the Waimakariri District is 18.5 people per square kilometer; although apart from Rangiora, Kaiapoi and Woodend, much of the 225,000 hectares the Waimakariri District occupies is rural land used for farming and where population densities are low.

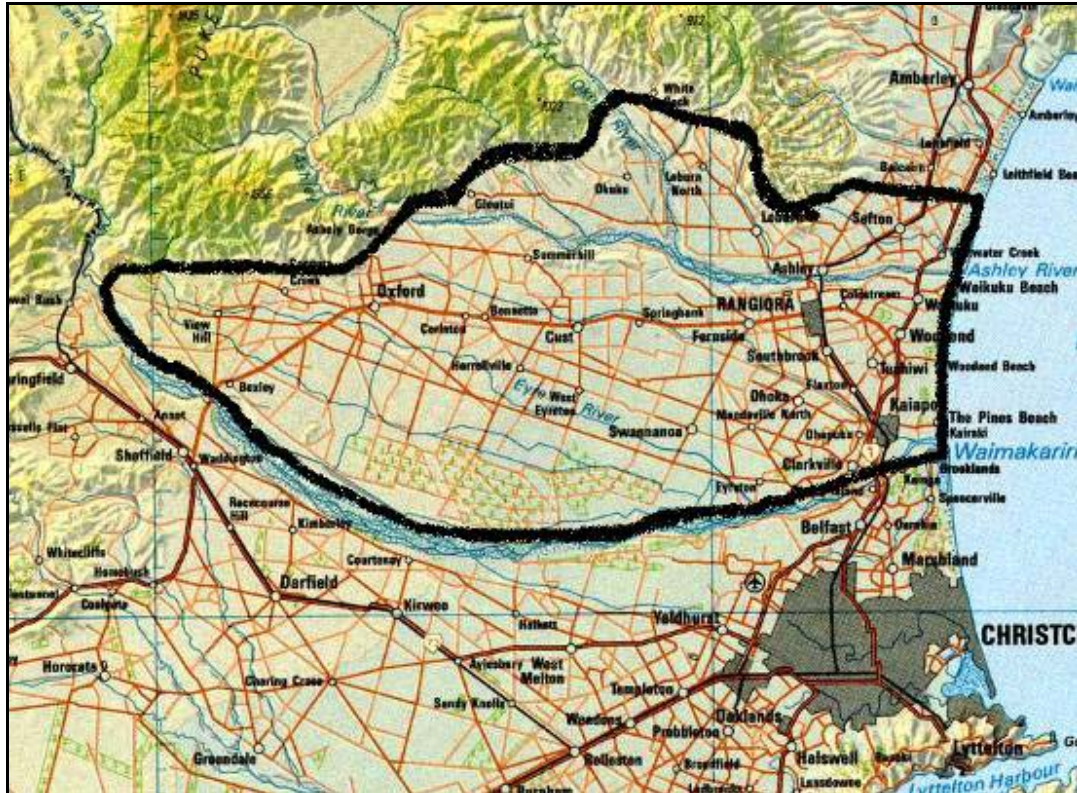


Figure 3.4: Map showing the Waimakariri District

Source: Topo Map 2.0

3.32 Current Public Transport Services

Public transport services connecting the Waimakariri District to Christchurch could be considered limited. A single bus service links Rangiora, via Woodend and Kaiapoi, to Christchurch; however timetable frequencies (see figure 3.5), are low and irregular and operation hours are limited during the evenings and weekends. The service is run by Red Bus and is a commercial operation looking to make profit. Therefore operation focuses on commuter journeys and children getting to and from school, and fares are fairly high with return cash trips from Rangiora and Kaiapoi at \$12 and \$8 respectively. The Rangiora bus accepts discount with the use of a Metrocard making return trips \$10.50 from Rangiora and \$6 from Kaiapoi. Using the Metrocard also enables free return journeys if the journey is made within two hours of initial fare purchase. Considering journeys from Rangiora take over an hour, the transfer window appears narrow.

Low frequencies of service, even during hours of peak demand, means buses are full to capacity on morning services, forcing patrons to stand in aisles. Level of service is also compromised by congestion on arterial routes in and out of the Waimakariri District during peak hour, which greatly increases service travel time, as can be seen from timetable predictions in Figure 3.5. Congestion adds almost 15 minutes to

the commuter journey on the 8.49am and 9.39am services. The resulting standard or quality of service is low.

RANGIORA to City via Kaiapoi and Belfast										
MONDAY to FRIDAY										
	Rangiora (Ashley St)	Rangiora (White St)	Rangiora (Ashley St)	Woodend (Main Nth Rd)	Kaiapoi (Police Station)	Belfast Shops	Papanui Shops	Bealey Ave	City Exchange	Hoyts 8
AM	6.35	6.40	6.46	6.53	7.01	7.13	7.25	7.32	7.37	7.46
	7.00	7.05	7.15	7.22	7.30	7.42	7.54	8.01	8.06	8.15
*	7.30	7.35	7.45	7.52	8.00	8.12	8.24	8.31	8.36	8.45
*	8.49	8.56	9.20	9.27	9.35	9.47	9.59	10.06	10.11	10.20
*	9.39	9.44	10.00	10.07	10.15	10.27	10.39	10.46	10.51	11.00
PM*	12.09	12.14	12.30	12.37	12.45	12.57	1.09	1.16	1.21	1.30
*	2.09	2.14	2.30	2.37	2.45	2.57	3.09	3.16	3.21	3.30
*	3.09	3.14	3.30	3.37	3.45	3.57	4.09	4.16	4.21	4.30
	EX DALE STREET				4.10	4.22	VIA CRANFORD STREET		4.44	4.49
*	4.19	4.24	4.40	4.47	4.55	5.07	5.19	5.26	5.31	5.40
*	5.09	5.14	5.40	5.47	5.55	6.07	6.19	6.26	6.31	6.40
*	7.06	7.11	7.20	7.26	7.32	7.42	7.54	8.02	8.07	8.12
*	9.06	9.11	9.20	9.26	9.32	9.42	9.54	10.02	10.07	10.12
FRIDAY NIGHTS ONLY										
PM	6.00	6.05	6.10	6.16	6.22	6.32	6.44	6.52	6.57	7.02
	6.50	6.55	7.00	7.06	7.12	7.22	7.34	7.42	7.47	7.52
*	8.06	8.11	8.20	8.26	8.32	8.42	8.54	9.02	9.07	9.12
*	10.21	10.26	10.35	10.41	10.47	10.57	11.09	11.17	11.22	11.27
* The bus will set down and pick up passengers at these times. There may be some delay at Ashley Street.										

* The bus will set down and pick up passengers at these times. There may be some delay at Ashley Street.

Figure 3.5: Rangiora Bus timetable.

Source: Available at: <<http://www.metroinfo.org.New Zealand/timetables>>

3.33 The Potential of Rail

Population growth in the Waimakariri District is predicted at 21% between 2001 and 2021 (UDS, 2005); growth which is amongst the highest in Canterbury. Travel time increases have been predicted for major roads in and out of Christchurch as part of the Urban Development Strategy. Commuting times are expected to increase 55% by 2041. On average, a 30-minute journey today would take 47 minutes in 2041. There are currently two arterial routes into Christchurch from the Waimakariri District: the Northern Motorway and Marshlands Rd. The increasing pressure placed on these already congested routes would see car travel times increase to beyond UDS predictions.

Levels of accessibility to rail are high for residents of Rangiora and Kaiapoi. The Main North Line which terminates in Addington runs through Kaiapoi and Rangiora, connecting the Waimakariri District to Christchurch. The energy efficiency and long-term sustainability of rail in transporting large numbers of people is evident. Ease in increasing passenger capacities is also an advantage given growth predictions. However the initial capital investment in a rail based passenger service would be a major hurdle in the implementation of a high quality service.

A report commissioned by Environment Canterbury and produced by consultancy firm GHD identified estimates of the costs of upgrading Canterbury's rail corridors, including the Main North Line servicing Kaiapoi and Rangiora. The proposed packages include upgrades of the Main South Line and the Midland line which would include services to Lyttelton and Rolleston. The five options identified by consultancy firm GHD are:

- Option 1 - utilizing the existing network
- Option 2 - double tracking and re-signalling to Belfast
- Option 3 - double tracking and re-signalling to Rangiora
- Option 4 - double tracking and re-signalling to Rangiora and Rolleston
- Option 5 – double tracking and re-signalling to Rangiora and Rolleston, plus the construction of a Central City Loop Underground.

(GHD, 2005)

Table 3.3 shows the costing estimates. Each option was broken down according to work required for upgrading infrastructure and the purchase of rolling stock (the train set). A figure of \$3.5 million per kilometre was provided by GHD for the construction of new rail lines necessary for double tracking current rail corridors. Costing estimates were based on overseas experience, particularly from rail development in the United Kingdom and Perth (GHD, 2005). A breakdown of cost estimates for option 1 include \$20 million for the purchase of rolling stock, \$15 million for required maintenance work and \$20 million for the construction of railway stations (estimated at \$2 million per station)(GHD, 2005)

Table 3.3: Total capital cost estimates for rail options

Option 1	Option 2	Option 3	Option 4	Option 5
\$55 million	\$105.5 million	\$201.5 million	\$246 million	\$690 million

The additional costs of double tracking and re-signalling (\$3.5 million/km) are represented in options 2-5 as well as the costing estimates of additional stations. Option 5 represents the most ambitious option discussed at the rail workshop. The \$690 million price tag gives is made up of an estimated \$250 million construction of a central city train and bus station. The estimate however does not include the enormous expense of tunneling which would be in the range of \$500 million - \$1 billion. This somewhat utopian option also includes electrification of the lines, costed at \$100 million.

Use of the existing infrastructure for a passenger rail system is of important consideration. Operating a passenger service for Rangiora and Kaiapoi would be difficult in the existing situation. As has been identified The Main North Line is single track and the signalling system is track warrant north of Belfast (see figure 3.6). Track warrant means a permit must be held to use the track meaning only one train can be on the section of track at any one time. It would be very difficult to timetable a passenger service in the morning due to current use of the line. It may be possible to fit two trains from Rangiora into Addington

during the morning, but precise operating schedules and communication would be necessary to prevent delays. Option 3 would be necessary for a high quality service operating on 30 minute headways throughout the day. Realistically this level of service would be required to have a significant long-term impact on the travel behaviour of the Waimakariri District residents.

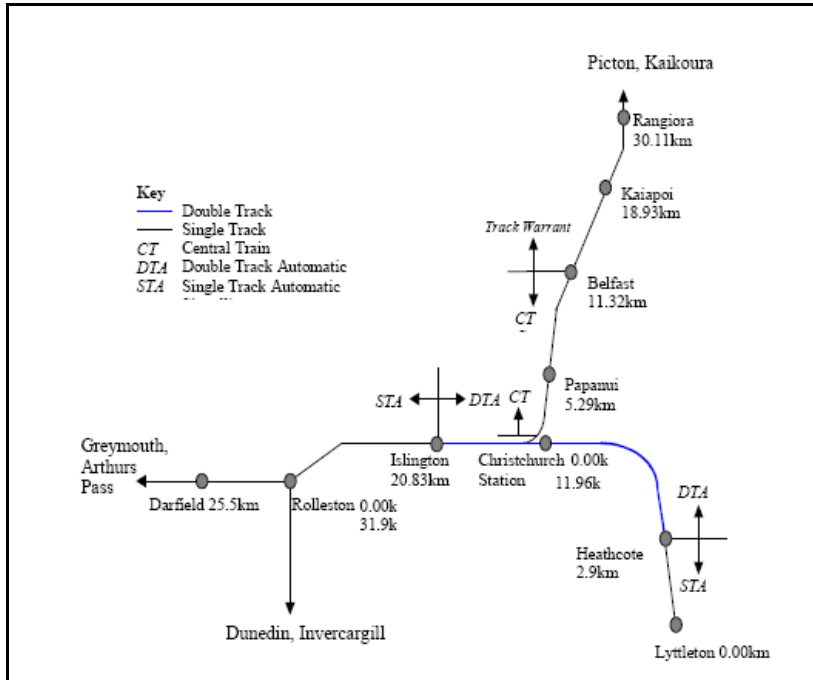


Figure 3.6: Layout of Canterbury's Rail Network displaying distances, number of tracks and signalling systems.

Source: GHD, 2005

The locations of possible train stations servicing the Christchurch's Central Business District (CBD) is also of some concern. A section of track recently removed from near Christchurch Station makes it impossible for a service to run straight down the Main North Line and on to the Main South Line to Lyttelton (see Figure 3.7). The train would have to have engines on both ends so that it could come in from the Main North Line and move along the Midland Line, giving it enough room out push out from Christchurch Station along the Main South Line. This operation from experience is time consuming and holds up road traffic twice due to the need to "back up" along the Midland Line to provide the room needed to move in the other direction. The replacement of the connecting curve is considered necessary even without the existence of regular daily passenger rail services operating within Canterbury.



Figure 3.7: Termination, or junction of Main North, Main South and Midland Lines at Addington Station

Source: Available at: <<http://www.ccc.govt.nz/maps/Wises/map13/MAP13>>

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Environment Canterbury openly states that they are currently looking at improving public transport through research into rail servicing the Waimakariri District (ECan, 2005a). Research is also being conducted on improving bus services within the Waimakariri District, with a more frequent and regular timetable, improved route and a fleet of new buses. Research has passed the phase of public consultation. However, any subsequent increase in the quality of public transport for residents of the Waimakariri District will coincide with an increase in rates for the entire district to help pay for the service. Christchurch residents currently pay Environment Canterbury rates of \$26.91 per \$100 000 of property value towards public transport while Waimakariri District residents pay 66c per \$100 000 of property value (ECan, 2005b). The bus service proposed by Environment Canterbury (see Appendix A) would require \$20 rates per \$100 000 rate-able property value within the Waimakariri District for a service operating 30 minute frequencies (ECan, 2005c). The cost of fares would decrease by \$2-3 from current levels. While improvements to public transport is needed for the Waimakariri District, this rates increase would be a very unpopular proposal for Waimakariri District residents, whose rates are already higher than Christchurch residents due to specialised rural rates such as rural fire control and water regulations.

The highest quality of passenger transport for the Waimakariri District would be an electrified, high frequency rail service. At the other end of the scale, using current infrastructure would limit options for Waimakariri District residents. The current Main North Line north of Belfast has severe limitations for additional capacity. The introduction of a basic commuter based service during the evenings and mornings

is restricted by current use of the line during peak commuter periods and the basic signalling system. Services currently using the Main North Line must meet ferry timetables in Picton. These services are therefore inflexible.

Transit New Zealand are looking at various options for increasing road capacities on arterial routes between Christchurch and the Waimakariri District. Congestion levels are high as commuters enter Christchurch from the Northern Motorway (State Highway 1) and travel through Belfast and Redwood along Main North Rd shown by the box outline in Figure 3.8. There is chronic congestion at the Main North Road, Johns Road intersection during peak hour traffic in the mornings and evenings, outlined by the sphere in Figure 3.8. Options identified by Transit New Zealand for easing congestion in this trouble spot range from increasing the number of lanes on existing roads through to creating bypass options for people wishing to avoid Belfast and central Christchurch altogether. High capacity ring roads would be established to access East and West Christchurch.



Figure 3.8: Area of chronic congestion through Belfast and immediately South of Waimakariri River

Source: Available at: <<http://www.ccc.govt.nz/maps/Wises/map13/MAP13>>

© Wises Publications Limited

When entering Christchurch from the Waimakariri District the Northern Motorway ends near the intersection of Dickey's Road and Main North Road large traffic volumes are reduced in speed from 100 to 50 kilometres per hour. Congestion at the intersection of Johns Road and Main North Road in Belfast during peak periods severely increases journey times for commuters. Transit New Zealand have considered increasing Northern Motorway capacities from 4 lanes to 6 (Beca Cater Hollings & Ferner, 2001); however the ramifications of such a modification is increased congestion in Christchurch at the termination of the motorway. Congestion also occurs at peak hours on Lineside Road, which connects Kaiapoi and Rangiora.

Transit New Zealand, in conjunction with the Waimakariri District Council has written plans to widen Lineside Road to four lanes in 2006/07.

Comparing the costs of road and rail upgrades for north Christchurch and the Waimakariri District is difficult. The large capital investment required for rail may cast a shadow on long-term benefits rail has over road use, benefits which are impossible to measure. Transit New Zealand has not provided cost estimates of the proposed upgrades of the Northern Motorway or projects around Kaiapoi and Rangiora.

3.34 Summary of Stakeholders Involved

Stakeholders involved in the implementation of rail for Canterbury on a regional scale are the Regional Council known as Environment Canterbury, the Christchurch City Council (CCC), Waimakariri District Council, Selwyn District Council and the Banks Peninsula District Council. Environment Canterbury currently plans, tenders and administrates public transport services for the region while the CCC provides the infrastructure, such as roads and bus stops. The CCC also regulates land use under the Resource Management Act so that if a proposed development does not adhere to the City Plan, application for resource consent would be sought for infrastructure within the city boundaries. Co-operation between regional and city councils in the development of passenger rail would be needed to limit the cost of implementing rail in Canterbury.

On a national scale, the Ministry of Transport through ONTRACK, a state owned enterprise, owns and controls the rail network on behalf of the government. ONTRACK grants access rights in the form of leases, for companies to operate freight and passenger services. Rolling stock is also owned and leased by ONTRACK to private companies. The contract to operate passenger rail may be leased to a private company as occurs in Wellington and Auckland, or be operated entirely by Environment Canterbury. Toll NZ, an Australian owned company, has national access rights to rail infrastructure for freight until 2070. Any development of the Canterbury rail infrastructure to increase capacity levels would be of benefit to Toll NZ.

Chapter Four:

Methodology

Two underlying principles of any rail feasibility study are firstly assessing the travel demands of the population; where people travel to and from.

Secondly, establishing at what times people travel.

Assessing current infrastructure and investigating the needs and locations of additional infrastructure are also important aspects of rail feasibility studies

4.1 Geographic Information Systems application

Geographic Information Systems are “a powerful set of tools for collecting, storing and retrieving at will, transforming and displaying spatial data from the real world for a particular set of purposes” (Burrough & McDonnell, 1998;pg11).

4.11 Recreating the Study Area

ESRI’s ArcGIS version 9.1 was used to create an interactive map of Christchurch and the Waimakariri District. Features added to a GIS included Canterbury’s CAUs and coastline as well as existing rail and road infrastructure. Canterbury’s Main North Line was the focus of analysis and railway stations were digitised onto this line at precise locations. Stations located along the Main North Line are:

- Rangiora
- Kaiapoi
- Belfast
- Redwood
- Papanui
- Mona Vale
- Addington

The locations of these stations were based on recommendations from Environment Canterbury’s Transport Policy Analyst via the attendance at a rail workshop held by Environment Canterbury in April 2005 and through review of an Environment Canterbury funded desktop costing study conducted shortly after. Stations were located in the highest population densities relative to the Waimakariri District (see Figure 4.1) as urban density is an important consideration in the implementation of any public transport service (Mees, 2000). The northern most stations in Figure 4.1 are Kaiapoi and Rangiora Stations. The locations of stations within Christchurch were based on increased access to popular destinations such as shopping malls, schools and areas of commercial activity (Mike Blyleven, pers comm., 2005). Access to the station was also considered based on current road infrastructure. Driving to stations is not encouraged; however pedestrians and cyclists also use road infrastructure to access train stations.

4.12 Selecting scenarios for analysis

Analysing the potential demand for a passenger service operating on the Main North Line initially meant finding the number of people within specified distances of identified stations located within the Waimakariri District. Literature on rail travel state that two kilometres is the maximum distance people are likely to walk to reach a train station (Gibbons & Machin, 2005). However average walking distances have been found to be as low as 600m (Kuby et al., 2004). Variables of one and two kilometres were chosen for analysis within the Waimakariri District to cover the range of possible walking distances. A third variable

of five kilometres was chosen to represent the upper range of travel to rail stations by way of cycling (Martens, 2004).

Distance variables for stations located within Christchurch (identified as destination stations) were limited to one kilometre. Generally people expect a public transport service to take them where they need to go or they will not use it. Expecting people to walk more than one kilometre at the destination end was considered hopeful. Additional public transport services, such as buses, transferring patrons at railway stations are needed to feasibly expand this one kilometre coverage area.

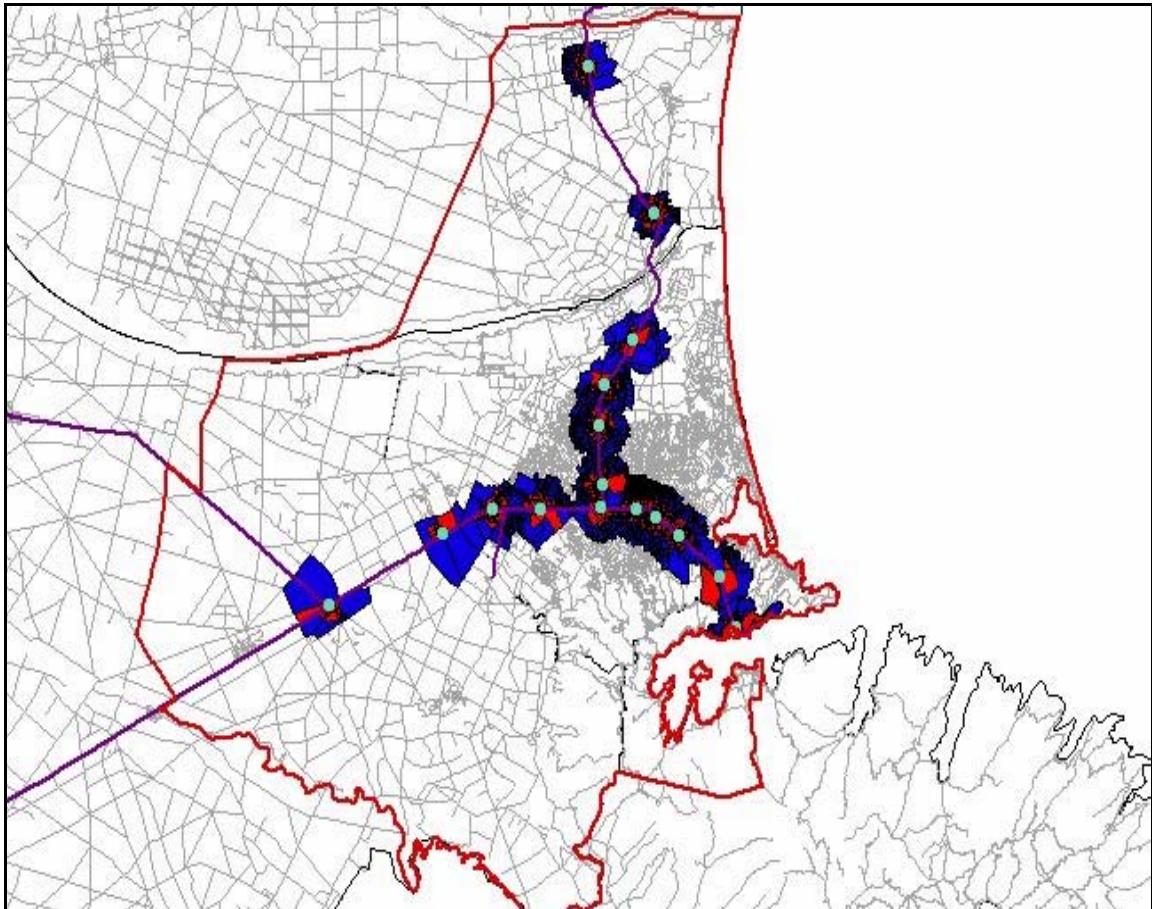


Figure 4.1: Locations of proposed stations

There is high potential in transferring from rail to bus at train stations. For this reason, bus routes which currently operate within 500m of a train station were chosen for analysis to investigate the possible coverage resulting from mode transferal. As has been discussed, Christchurch's bus service is sophisticated and services cover much of Christchurch. Integrated ticketing and transferring would be required to facilitate required modal interchange (Jefferson, 1996; Mees, 2000).

Two specific bus routes were also chosen to independently investigate demand for areas serviced by the routes. Bus routes chosen were the Orbiter and Cashmere buses. The Orbiter follows an orbital route around Christchurch, servicing a wide range of locations. The loop takes approximately one hour to complete, depending on traffic levels. The Orbiter route is located within 400m of the Addington train station and within 200m of the Papanui station and is a popular service due to the high frequency of buses (10 minute headways during the day), which operate on both clockwise and anti-clockwise directions. Transferring in either direction would be achievable.

The number 10 Cashmere bus currently operates within 200 metres of the Papanui station and provides a direct route from Papanui into the Christchurch Central Business District (CBD). Accessing the CBD by train is a problem given the location of current infrastructure. Addington Station is approximately 2.5 kilometres from the CBD while Moorhouse Station located on the Main South Line would be 1 kilometre from the CBD. Given current infrastructure, Moorhouse Station is also now difficult to access from the north. Transferring from rail to a bus that directly services the CBD at Papanui is a viable option. However the introduction of bus lanes due to current traffic levels along Papanui Road would be necessary to increase travel speeds and decrease travel times. The Cashmere bus also services Christchurch Airport, which has a large employment base, with transferring possible at Papanui also.

To investigate the full potential of transferring from rail to bus from stations along the Main North Line, all bus routes which currently operate within 500m of stations within Christchurch were chosen for analysis. It was also decided that all Waimakariri District residents' work destinations would be analysed to evaluate total transport patterns and needs.

4.13 Managing Data

The data received from Environment Canterbury for analysis was 2001 Census journey to work data; data resulting from a combination of usual residence and workplace address questions (Statistics NZ, 2005). All modes of transport were provided for the journey to work and the total number of journeys column was used for analysis which was a combination of all modes. Locations were provided per Census Area Unit (CAU) which are defined statistical areas used by Statistics NZ. CAUs are the second smallest unit of dissemination of census data in New Zealand, each representing approximately 2,300 people. The journey to work data was essentially a matrix of travel from any given CAU to every CAU. For the purposes of this study CAUs only covered the Waimakariri District and Christchurch City. Further, origin or CAUs of residence used were only those from the Waimakariri District. Destination, or CAUs of usual employment included both the Waimakariri District and Christchurch City. The selection of data was used to make the data set more manageable.

The journey to work data was organised into a matrix of the relevant CAU codes, for the purpose of attaching the matrix to a GIS shapefile representing the physical boundaries of Canterbury's CAUs. It was hoped that joining the data based on matching the CAU codes would enable analysis of the data within ArcGIS. However the data could not be added to the Canterbury CAU shapefile due to the limitations of ArcGIS v 9.1 in handling a large dataset. Variables therefore had to be selected within the GIS and exported to Microsoft Access where the journey to work data could be analysed.

4.14 Supply and Demand Populations

Population weighted centroids (PWCs) of census tracts were used to determine which CAUs were included in each particular variable. A national address database was used to calculate the geographic centre of each CAU according to the distribution of addresses. The use of the address database was considered for calculating the proportion of Waimakariri District residents per CAU captured by a buffer based on the number of residential addresses. However because analysis could not be made within the GIS the number of variables used during analysis would have dramatically complicated the query process within Microsoft Access. PWCs were chosen over geometric centroids, because PWCs take into account the location of urban densities within the CAU and therefore are more accurate representations of population locations (Luo, 2004; Wang & Luo, 2005). Some CAUs, especially within rural areas within the Waimakariri District, are quite large and urban development may be limited to a particular corner of the CAU. For this analysis the distribution of urban development; residential and commercial, was an important consideration.

One and two kilometre buffers were placed around digitised railway stations in GIS using the buffer technique (see Figure 4.1). The buffers were used to identify which CAUs would need to be analysed for their journey to work data. If a CAUs' PWC fell within a buffer, that CAU was included for the variable being analysed. 500m buffers which were placed around two key example bus routes chosen to identify the CAUs contained within the buffer. To investigate the full potential of transferring from rail to bus, an all encompassing buffer was also placed around stations within Christchurch and current bus routes which pass within 500m of these stations (see Figure 4.3). Again, Census Area Units with population weighted centroids which fell within this buffer were analysed for their journey to work data (see Appendix B). The purpose of this large buffer was to identify the total number of commuters within two kilometres of stations in the Waimakariri District who could potentially use public transport for the journey to work. This method provides a maximum number of potential journeys

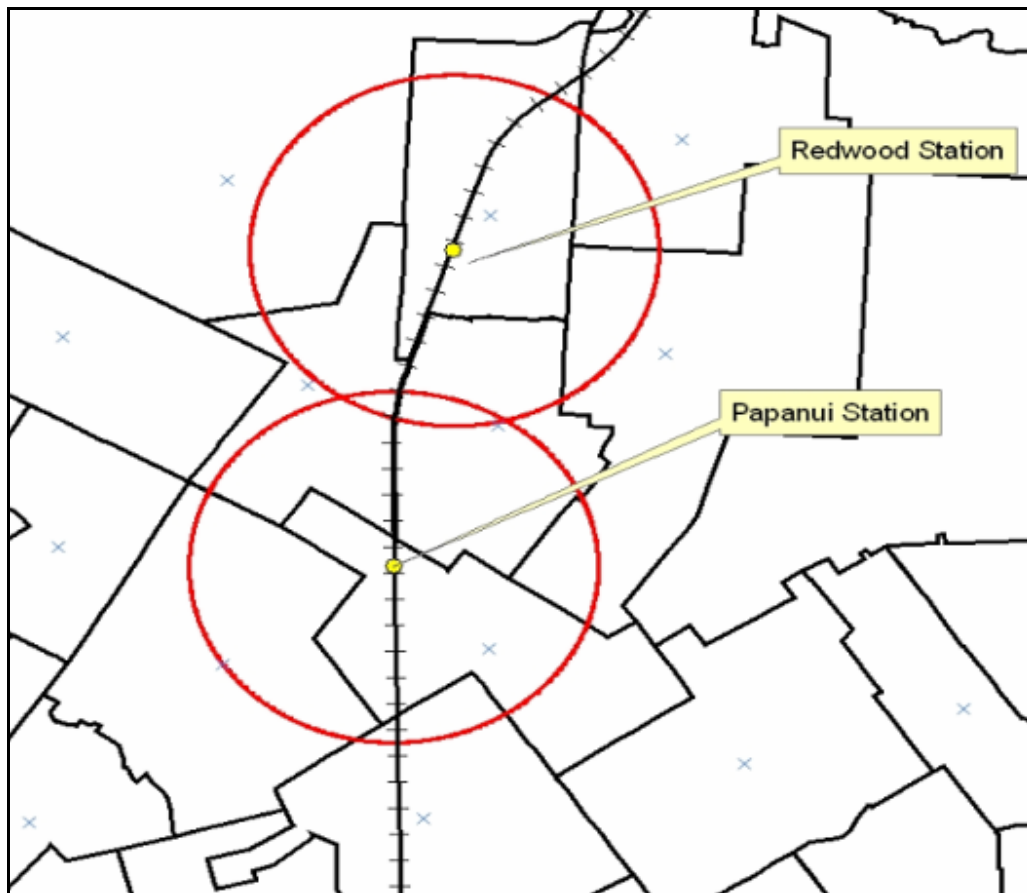


Figure 4.2: 1km railway station buffers capturing Population Weighted Centroids

Source: ArcGIS v9.1 (screenshot)

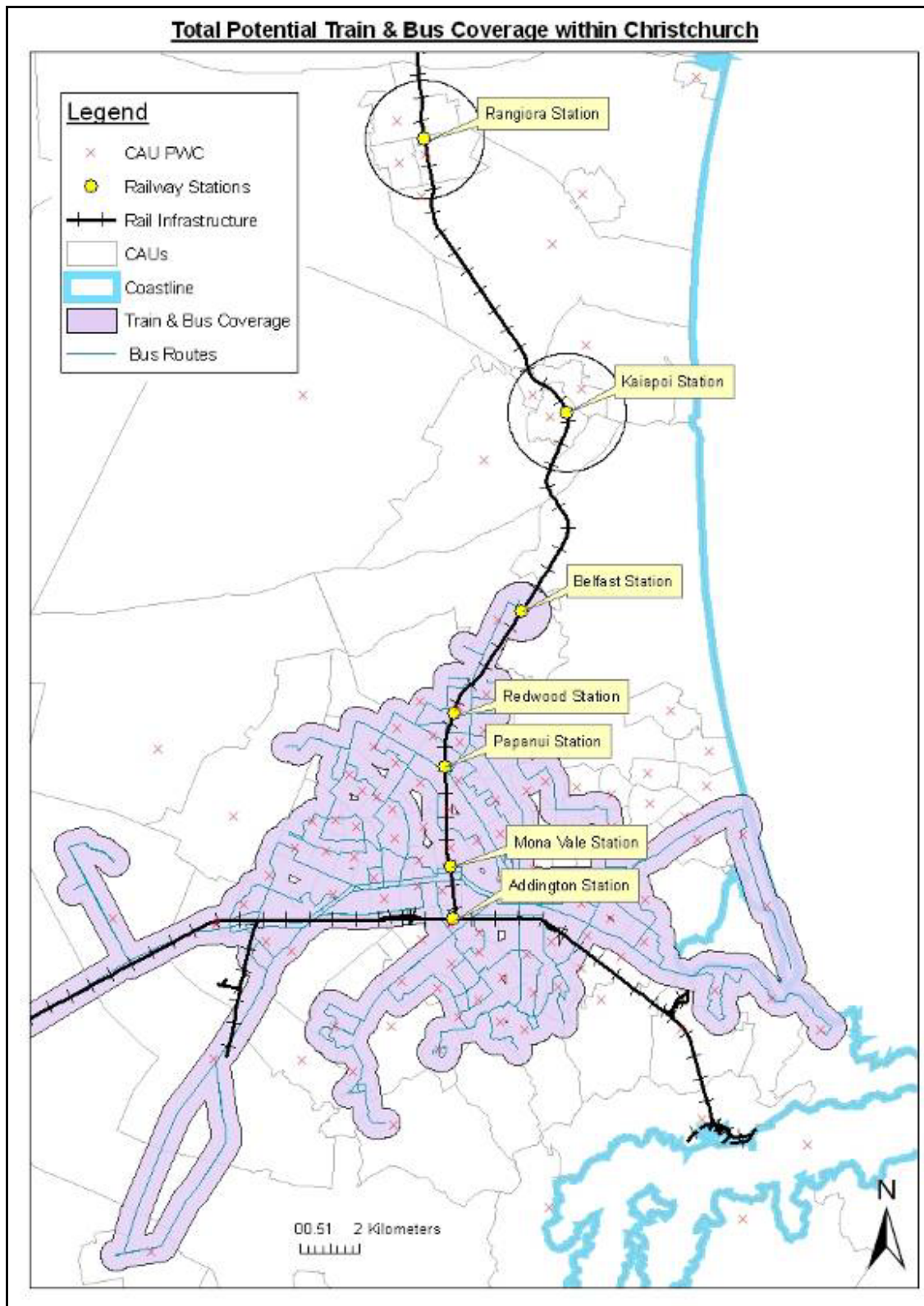


Figure 4.3: 500m buffer of bus routes within 500m of identified stations showing PWC selected

4.15 Querying the Data with SQL

Buffer variables identifying the relevant Census Area Units were exported into Microsoft Access to query the journey to work data people living in those Area Units (see Figure 4.4) Each buffer identified a set of CAUs for each variable chosen. Each set of data containing the relevant CAU identification codes (IDs) were exported into Microsoft Access as a table. Microsoft Access then allows a number of tables to be cross-tabulated to retrieve the required data through using Standard Query Language (SQL).

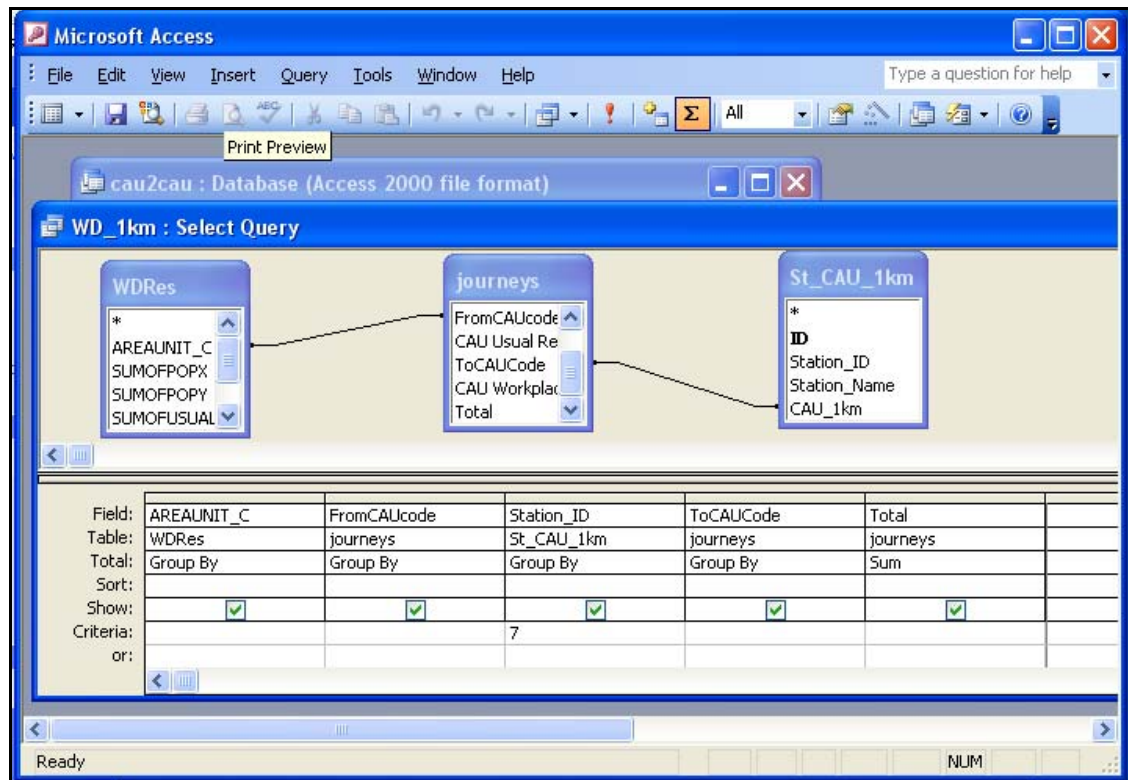


Figure 4.4: Microsoft Access query

Source: Microsoft Access (screenshot)

SQL was used to link the respective tables by asking Access to use one table of CAUs as journey origins and another table of CAUs as journey destinations. These queries were used to extract journey to work data from the large matrix. In this case the origin and destination buffer CAU IDs were matched to their respective journey to work CAU IDs and the corresponding journey to work data was retrieved, giving the number of journeys possible for each scenario. An example of a query is shown in figure 4.4.

Transport flows created in Microsoft Access were then transferred back to a GIS to display the results using graduated colours to display results within the respective buffers. Results from buffer analysis were calculated as a proportion of total journeys made from the total number of residents who work within

Christchurch. Total population numbers gave the proportion of trips given the total population of the Waimakariri District.

4.2 Surveys Conducted

4.21 Written survey

A written survey was always planned for an evaluation of Waimakariri District residents' travel needs. The process with which the survey was conducted relied on either an insert into a Waimakariri District Council (WDC) rates drop or an agreement with Environment Canterbury for space on a Waimakariri District public transport consultation brochure. An insert into a WDC rates drop for approximately 36 000 residents would have required funding of a free post return address. The organisation of a prize draw for those responding was also discussed with the WDC. ECan offered three sides of a fold out brochure, enough space for more than 20 questions, in return for analysis of 2001 Census journey to work data. A contract was drafted by ECan's Transport Policy Analyst, however the contact left his position at Environment Canterbury to work for Transit New Zealand and the number of questions allowed on the final brochure was limited to three. Understandably the Environment Canterbury brochure was attempting to gauge demand for increased levels of bus service in the Waimakariri District and the same number of questions on rail would have both confused respondents and undermined ECan's attempts to run bus services in the Waimakariri District. It also became apparent during the latter half of this research that ECan did not want to mislead the public as to their commitment to a rail service. In retrospect, co-ordinating with a Waimakariri DistrictC rates drop would have provided more control over proceedings.

The ECan brochure was sent out to residents in Kaiapoi, Rangiora and Woodend in October 2005 (located in Appendix A) The brochure itself was a Waimakariri District resident consultation for the extension of metro bus services into the Waimakariri District, giving residents the option of retaining the current level of service or gaining an increased level of service.

The three questions that were included on the Environment Canterbury public transport brochure were:

1. What is currently your main mode of transport to work or place of education?
2. Would you consider switching to rail?
3. Where is the main destination you commute to?

Environment Canterbury included space for the respondent to fill out their address. A combination of address and destination responses (resulting from question three) from Waimakariri District residents would enable the analysis of residents' levels of access to current infrastructure based on where residents lived and the location of their main destination in Christchurch. Analysis was to be done by geo-coding locations in a GIS (locating points via address locator databases). Journeys could then be assessed according to origin and destination distances from the existing rail infrastructure.

Potential journeys could then be calculated using question 2 to provide a percentage of Waimakariri District residents who would switch from their current mode of transport to rail as their main mode of transport. Question 1 was designed to assess current modal share for regular journeys made to Christchurch. Given the current level of public transport service connecting the Waimakariri District to Christchurch, question 1 was designed to calculate levels of public transport use for the journey to work compared to Christchurch. Modal share percentages could then be used to estimate the number of additional journeys Waimakariri District residents make by car. Increasing public transport modal shares can also show how many journeys could potentially be made by public transport given the provision of efficient and affordable services. Results from the GIS analysis could then be calculated according to the proportion of residents regularly travelling to Christchurch who were prepared to use rail as their main mode of transport.

4.22 Phone Survey

Environment Canterbury also funded a phone survey as part of their Waimakariri District public transport consultation process. The survey was designed for evaluating current use of the existing bus service. The phone survey provided opportunity for questions which were left out of the brochure to be included.

Although the survey was funded by ECan, the survey conduction was organized and run by Field Connection Limited in Christchurch, a market research company. The survey was conducted during the afternoons and evenings to account for people working during the day. The survey included a total of 200 residents made up of 100 Rangiora residents, 80 Kaiapoi residents, and 20 Woodend residents. Phone interviews followed a transcript prompt for asking questions (Appendix A), which was prepared by Field Connection Limited and phone numbers were chosen at random from the phone book..

Questions for rail were provided to Environment Canterbury which were then passed on to Field Connection Ltd. The questions provided were:

1. Do you travel into Christchurch most days for work or education?
2. What mode of transport do you most often use to travel into Christchurch?
3. Where do you travel to?
4. When traveling into Christchurch, what is your biggest concern?
A: Increasing congestion
B: The cost of travel
5. If there was a passenger rail service operating on the current rail line (Rangiora – Kaiapoi – Christchurch) would you regularly use it for your commuter journey?
6. If No or Depends, please state why?

7. What is the highest fare you would pay for a return rail fare to reach your destination in Christchurch (including transfers to bus)?

Questions were designed to gauge public demand for passenger rail as well as to assess the reality of people using a passenger rail service operating on the current infrastructure depending on their travel patterns.

Question 3, asking where people regularly travel to, was important for assessing the transport needs of the sample population. A residential location question was already included in the phone survey which could be used to locate residents' travel patterns and it was advised for the purposes of this research that accurate locations were needed for both the residence and main destination of the respondent.

4.23 Focus Groups

Focus groups were funded by Environment Canterbury and run by The Field Connection Ltd. There were three focus groups run during the evening. Each focus group was from a selected area of Canterbury. Group one was selected specifically from Rangiora and Kaiapoi. A range of ages over 16 years, gender, current transportation methods, socio-economic status and occupations were chosen through a random focus group recruitment phone survey (Appendix A). A set of questions were supplied for the purposes of this research to Environment Canterbury (Appendix A), who instructed Field Connection Ltd to lead discussion towards the following objectives:

- To identify public perceptions of passenger rail
- To identify potential public usage of rail
- To explore possibilities/expectations of interchange with other public transport passenger services
- To identify service expectations relative to cost

There were six participants in the Waimakariri District group. Focus groups were conducted in a room purposefully designed for the facilitation of focus group discussion at Field Connection Limited, in Christchurch. Discussions lasted approximately two and a half hours and were directed by an experienced qualitative director. Video links enabled visual and audio feeds to view focus groups from a separate room so analysis of the group responses could be recorded.

4.3 Infrastructure Assessment

4.31 Rail Workshop and Charters

Attendance at a rail workshop held by Environment Canterbury clarified the existing status of Canterbury's rail infrastructure. The workshop was attended by representatives from the Christchurch City Council, Toll NZ, GHD and ECan. GHD are a large international commercial services company involved in the design

and construction of rail services. Toll NZ is a large rail operator including freight and passenger rail services. Toll NZ has long term exclusive access rights granted by ONTRACK through to 2070 for freight, existing long distance urban passenger services and the Wellington metro passenger service (Ministry of Transport, 2005b) The workshop was a discussion of the potential and the limitations of the current infrastructure for passenger rail services for Canterbury. Current signalling systems and the number of tracks in place along sections of Canterbury's railway lines were evaluated according to the level of service that could be provided using current infrastructure or through development. Current use of the infrastructure including the movement of freight and a daily single-trip passenger service was also discussed with regard to operating a service to the Waimakariri District using the current infrastructure. A number of options were raised for the development of the infrastructure to sustain a service with frequency levels higher than those which the current infrastructure and signalling system could realistically provide.

Following from the rail workshop, several informal interviews were conducted with Roger Sutherland, the owner of Rail Tours NZ, who run rail charters within New Zealand and Australia. Roger has an extensive knowledge of the Canterbury rail infrastructure and rolling stock. Operating Rail Tours NZ requires careful journey planning and timetabling. It was useful to talk with Roger about the various possibilities and issues raised during the rail workshop. A clear understanding of the rail infrastructure and mechanics of operating a basic service on current lines was provided through a tour detailing the locations of old stations which have retained their concrete platforms. An assessment of the stations also included the availability of space in the area for the construction of a station terminus, park and ride and cycle and ride facilities. The tour provided included the working mechanics of the current infrastructure such as the operation of traffic light signals and barrier arms at road junctions. Communication with Roger was used to assess the potential of using the current infrastructure for a basic commuter service operating during the mornings and evenings.

Help was provided for a day long passenger rail operation by Rail Tours NZ for the Lyttelton Port Open Day, to witness the logistics of a rail service operating on the current infrastructure. The rail service provided included two return journeys from Christchurch Station located in Addington, to Lyttelton. Journeys started with travel north, picking people up at Papanui and Belfast stations, before travelling back south through Christchurch Station and along the Main South Line to Lyttelton. The day's operation revealed some obvious limitations in the current infrastructure, particularly the junction around Christchurch Station where the three lines terminate at Addington Station (see Figure 3.7).

Chapter Five:

Results

This chapter analyses results from Waimakariri District resident surveys, focus groups and GIS analysis.

The potential number of journeys to be made by rail and supporting services is presented with reference to population growth.

5.1 Resident attitudes to rail

5.11 Results from brochure survey

Brochure results were received from Environment Canterbury in spreadsheet form. 710 responses to the brochure were received in total; however the quality of the data was low. A large proportion of respondents had not answered all the questions. Importantly for the purposes of this research the main destination locations provided were simply street names at best with many people simply listing Christchurch as a general location although it stated that a nearest intersection was required. People were either not willing to reveal their work location or did not read or answer the question on the brochure. Locating the received addresses on a GIS map through geo-coding would have been highly inaccurate as some streets cover large distances. Residential addresses were provided by some respondents, however without accurate destination data, plotting journeys based on distance from infrastructure was highly inaccurate.. 442 (62.5%) of the 710 respondents gave Christchurch locations (anywhere in Christchurch) as their main commuting destination (all figures are rounded to one decimal place). However, 167 people did not respond to this question at all, meaning 81% of people who answered the question gave a location within Christchurch. Of the 442 respondents who gave Christchurch locations, 69% answered yes to the question “would you consider switching to use rail?” (ECan, 2005), not including the 19 people who did not respond to this question.

Current modes of transport were analysed for the 442 respondents who stated they were commuting into Christchurch. Of the 442 respondents, 77.7% (excluding the 66 who did not answer the question) stated that car travel was their current main mode of transport for reaching Christchurch. 20.2% stated that the bus was their current main mode of transport with 1% of respondents cycling and 1% walking.

5.12 Results from phone survey

Of the 200 Waimakariri District residents surveyed through the phone survey, 32.5% (65 people) stated that they travelled into Christchurch for work or education purposes with 62% of the 65 respondents travelling into Christchurch on a daily basis. Waimakariri District residents who currently travel into Christchurch for work or education purposes were asked what their biggest concern was when travelling into Christchurch. Of the 32.5% who travel into Christchurch for work or education (65 respondents) 45% stated that increasing traffic congestion was the biggest concern, 26% cited the cost of travel as the biggest concern while 17% cited travel time as the biggest concern.

The locations of origins and destinations provided by respondents traveling into Christchurch for work or education were too vague to geo-code into a GIS. Street names were provided without addresses or nearest intersections; streets can cover more than one CAU which makes plotting a particular location on a map a pointless operation due to a complete lack of accuracy. It was mentioned by Field Connection Limited that phone survey respondents are unlikely to reveal their home and work addresses to someone over the phone, due to a lack of credibility on behalf of the person conducting the interview over the phone (Brenda Snook,

pers comm, 2006). Some destinations provided locations accurate enough to plot on a map, such as shopping malls, intersections or a specific location. However residential addresses were also unable to be provided by The Field Connection Ltd due to privacy laws and therefore analysis of the journey to work or education for phone respondents was unable to be processed.

Phone survey data were primarily used to investigate Waimakariri District resident's attitudes to passenger rail. 60% (120 respondents) of the 200 interviewed responded yes to the question "do you consider that the public transport system in your area should be improved" (The Field Connection Ltd, 2005). 77.5% of the 120 respondents stated that improvements to the current system should be in the form of increased frequencies, 23.3% cited an increase in the range of destinations and 16.6% would like a reduction in public transport fares.

The phone survey directly asked preference for a passenger rail service with 73.5% (147 respondents) stating that they would use rail if it met their fare requirements, a slightly higher number found in the brochure survey. 17% of the 147 respondents stated they would use rail on a daily basis, with a total of 51% using it at least once per week. 34% of respondents stated that they would use the service once a month or less. Frequencies of use were spread fairly evenly across Rangiora, Kaiapoi and Woodend.

The questions in the phone survey used to gauge estimates of what Waimakariri District residents thought was a reasonable fare for passenger rail transport was: "what price would be a reasonable fare for a return trip to Christchurch by rail?" and "what price would be considered expensive enough to utilise another mode of transport. Both these questions were answered by the 147 respondents who had previously stated they would use a rail service. There were variations between Rangiora, Kaiapoi and Woodend for both these questions. The majority of Rangiora (45.9%) and Woodend (50%) respondents stated that \$10 would be a reasonable price for a return fare to Christchurch while a higher majority of Kaiapoi (68.8%) residents stated that \$6 or less would be a reasonable price. Of all respondents who answered this question 8.8% indicated a reasonable rail fare which is above the currently set bus fares. Current public transport fares on the bus service operating from Rangiora and Woodend are currently \$12 and \$11 respectively while cash return fare from Kaiapoi is currently \$8. Subsequently, satisfactory fares were determined by distance from Christchurch and current bus fares from these destinations. Fares deemed too expensive followed similar spatial trends; 86.5% of Rangiora residents stated that \$10 or more was a fare deemed too expensive compared to only 64% of Kaiapoi residents.

5.13 Response from focus groups

Focus group respondents expected a high quality rail service but had little comprehension of the costs involved in the necessary upgrades required to support the level of service. Focus groups in general stated that rail must not cost more than using a vehicle which for them meant the weekly amount spent on petrol. Although there are a range of other costs associated with owning and operating a motor-vehicle, people will generally only consider how much it costs to actually run the vehicle on a weekly or daily basis. For example vehicle depreciation is a hidden cost which is rarely considered. The well organised integration of bus with rail was deemed necessary by focus groups for providing a wider coverage of destinations. Integrated ticketing as part of a return trip fare was also an important consideration for the success of the public transport journey. People become concerned when they are forced to pay two fares when transferring from one mode of transport to another.

The first focus group run was for residents of the Waimakariri District. Six people attended the focus group; four woman, two men, with ages ranging from 20 to 75. The Waimakariri District focus group initially responded enthusiastically to the idea of passenger rail services operating within the Waimakariri District and specifically linking the Waimakariri District to Christchurch. Train services were perceived as capable of operating to strict timetables through being separated from the traffic and of being safe and reliable. People also mentioned New Zealand's strong rail history and the popularity of the train. The general feeling was that people would use a train service if one were available. The primary negative people associated with rail were the inflexible nature of the route. A consensus was reached amongst the Waimakariri District focus group that well coordinated bus services integrated with passenger rail would be needed to increase the range of possible destinations. One member of the study area group stated that he could not use a service because it did not take him where he needed to go, which was Christchurch Airport, a location becoming less accessible due to increasing traffic congestion.

The main concern for focus group members was that rail did not take them where they regularly needed to go. Comments on the locations of current stations at Addington and Moorhouse included *"the main station is at Addington and that is far away from the central city and it is hard to go from Addington to the central city"* and *"they shifted the railway station out to Addington, so I would have to get a bus to town and that is a fare on top of a fare. It is too much to expect"*. There was also much concern and lack of comprehension among participants when cost estimations were provided. Figures of \$3 million per kilometre appeared extremely high to the study area focus group with one woman stating *"put us off by saying \$1 million per kilometre, who's going to pay for it?"* Waimakariri District residents would need the cost involved in upgrading the existing network to support a fairly frequent and regular service broken down into separate components for them to know what the money is used for.

Waimakariri District residents may also need to subsidise any service through increases in local rates unless the service was fully funded by the government. There was much debate when the subject of rates increases was raised by the focus group facilitator. Rates increases have already risen in the Waimakariri District during 2005 and further increases were a sore point for homeowners. Points of view in the group on rates increases ranged from a user pays approach through to rail benefits the entire Waimakariri District and everyone should contribute. It was not mentioned by the focus group coordinator that proposed rates increases for increased bus services in the Waimakariri District would only include those households in urban, not rural areas. It is therefore possible that rates increases for passenger rail would look at a similar approach by rating contributions towards a passenger rail service higher in urban areas than rural areas.

Waimakariri District residents were concerned with the increases in travel times for commuting into Christchurch. One of the group said travel times seemed to increase by about 3 minutes every 6 months. Access to the Waimakariri District was becoming a problem. One respondent had decided to move closer to Christchurch to save on total transport costs. There was suggestion that increased levels of public transport for the Waimakariri District would encourage people to live there. The group also emphasised that the level of service must be high for it to have an impact on travel behaviour. Secure, well designed stations for park and ride, and cycle and ride were considered necessary. Respondents also preferred stations to be located in central Kaiapoi and Rangiora.

5.2 Passenger service for the journey to work

5.21 Journeys feasibly made by rail

According to the 2001 Census the total population of the Waimakariri District was 36, 906. Of the 36, 906 residents, 18, 282 were employed in full or part-time work. Close to 40% of Waimakariri District residents in employment were shown to work within the Christchurch City boundaries; 40% representing 6,969 people. Identifying how many of the 40% of work journeys originating in the Waimakariri District and terminating in Christchurch City provided an indication of the number of people capable of using public transport for this journey based on the 2001 Census data.

The distribution of Waimakariri District resident's work origins and destinations are shown in Figures 5.1 and 5.2. The origin of Waimakariri District residential locations for those in employment is shown per CAU. Each CAU contains approximately 2,300 people but the proportion of people in employment varies dramatically.

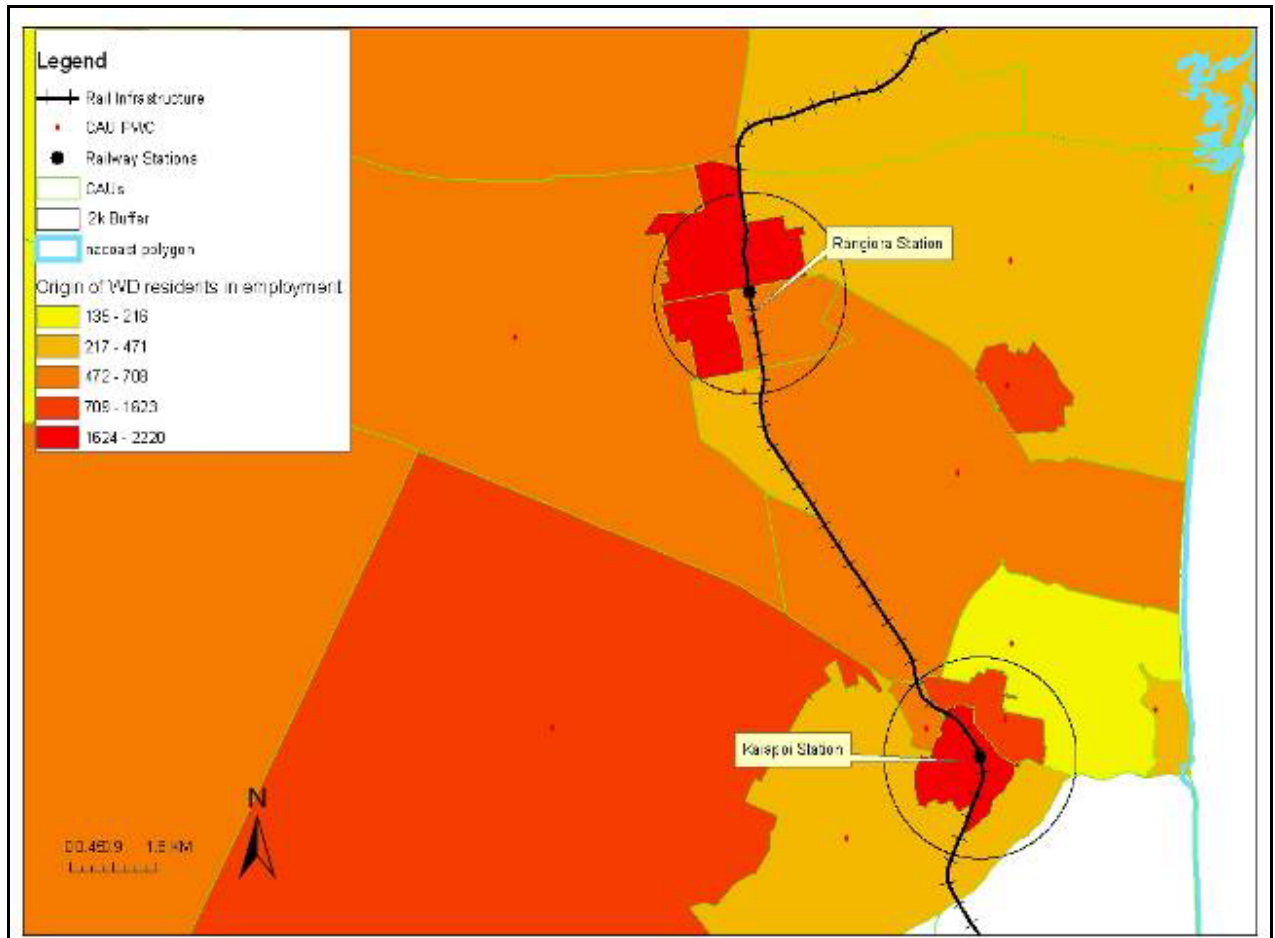


Figure 5.1: Number of Waimakariri District residents in employment per CAU

Figure 5.2 displays the distribution of Waimakariri District resident's employment within Christchurch shows that the highest numbers of jobs are still located within the Christchurch CBD. CAUs adjacent to the CBD also have high numbers of jobs. Large industrial areas are shown by two CAUs just West of Addington Station, below the Midland Line, which have 222 and 270 Waimakariri District residents working within them. 381 Waimakariri District residents also work in the Yaldhurst CAU which includes Christchurch Airport, a large job provider and a location previously made highly accessible to Waimakariri District residents due to their ability to bypass central Christchurch on the journey to work. 330 Waimakariri District residents also work in the Belfast CAU which holds the location of the Belfast Station. Belfast is highly accessible to Waimakariri District residents due to the current Northern Motorway's termination there; also while the Belfast CAU is a large one the population weighted centroid shows that the majority of development is centered close to the proposed Belfast train station.

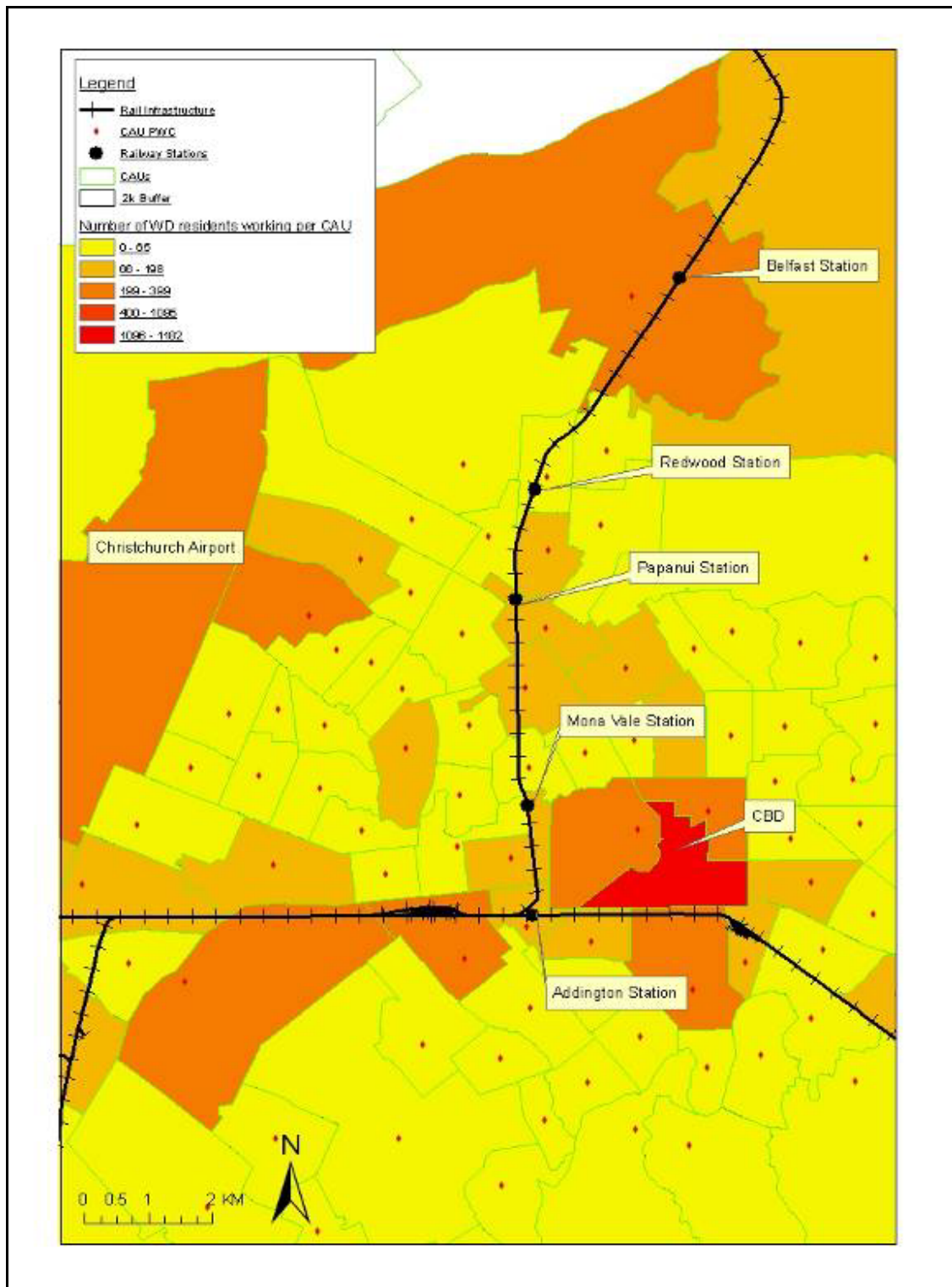


Figure 5.2: Number of Waimakariri District residents working within individual CAUs for Christchurch

Figure 5.3 shows the number of journeys from the CAU of the single population weighted centroid which fell within the Rangiora Station one kilometre buffer. There were 30 journeys in total from the Rangiora one kilometre CAU to one kilometre buffers of Kaiapoi and Christchurch Stations. Of these 30 journeys, 12 were to Kaiapoi Station with only 18 journeys to stations within Christchurch.

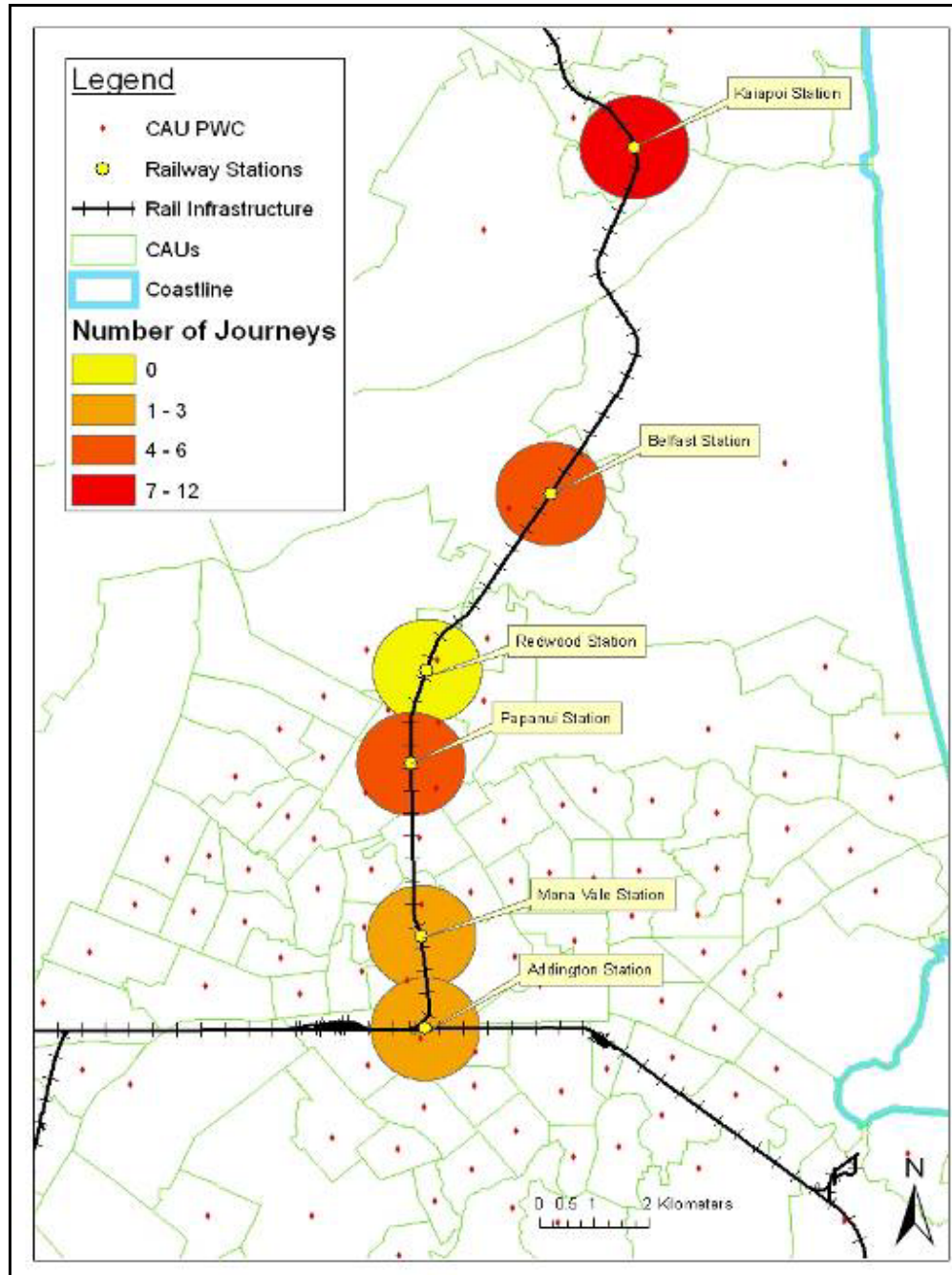


Figure 5.3: From within 1km of Rangiora Station to within 1km of identified Kaiapoi and Christchurch Stations.

Figure 5.4 includes 3 CAUs that were included in the two kilometre buffer of Rangiora Station. Three more CAUs were added to the one kilometre buffer, resulting in an increase from 30 to 279 total journeys found, which included 102 journeys to within one kilometre of Kaiapoi Station. There were also significantly more journeys to Belfast and Papanui Stations compared to Figure 5.3; up from 6 to 66 and 6 to 48 journeys respectively.

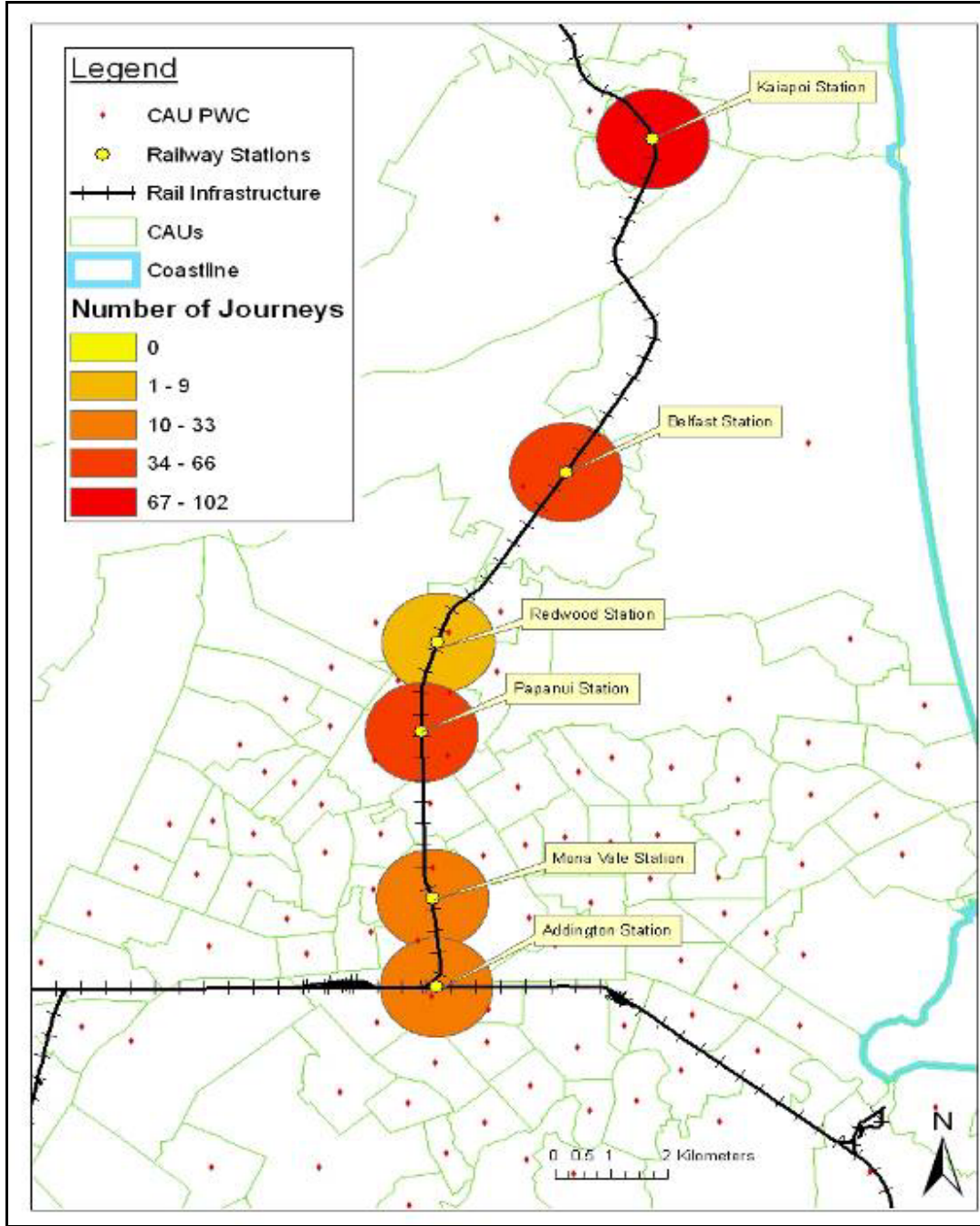


Figure 5.4: Journeys from within 2km of Rangiora Station to within 1km of identified Kaiapoi and Christchurch Stations

Figure 5.5 moves to journeys from Kaiapoi Station. There were 3 CAUs included in the Kaiapoi one kilometre buffer which totaled 309 total journeys to within one kilometre of other stations. 105 and 93 journeys were recorded for Belfast and Papanui stations respectively, with 45 to Mona Vale. 36 journeys were also recorded back up the Main North Line for the single CAU representing Rangiora one kilometre. 15 journeys were recorded for Addington and Redwood.

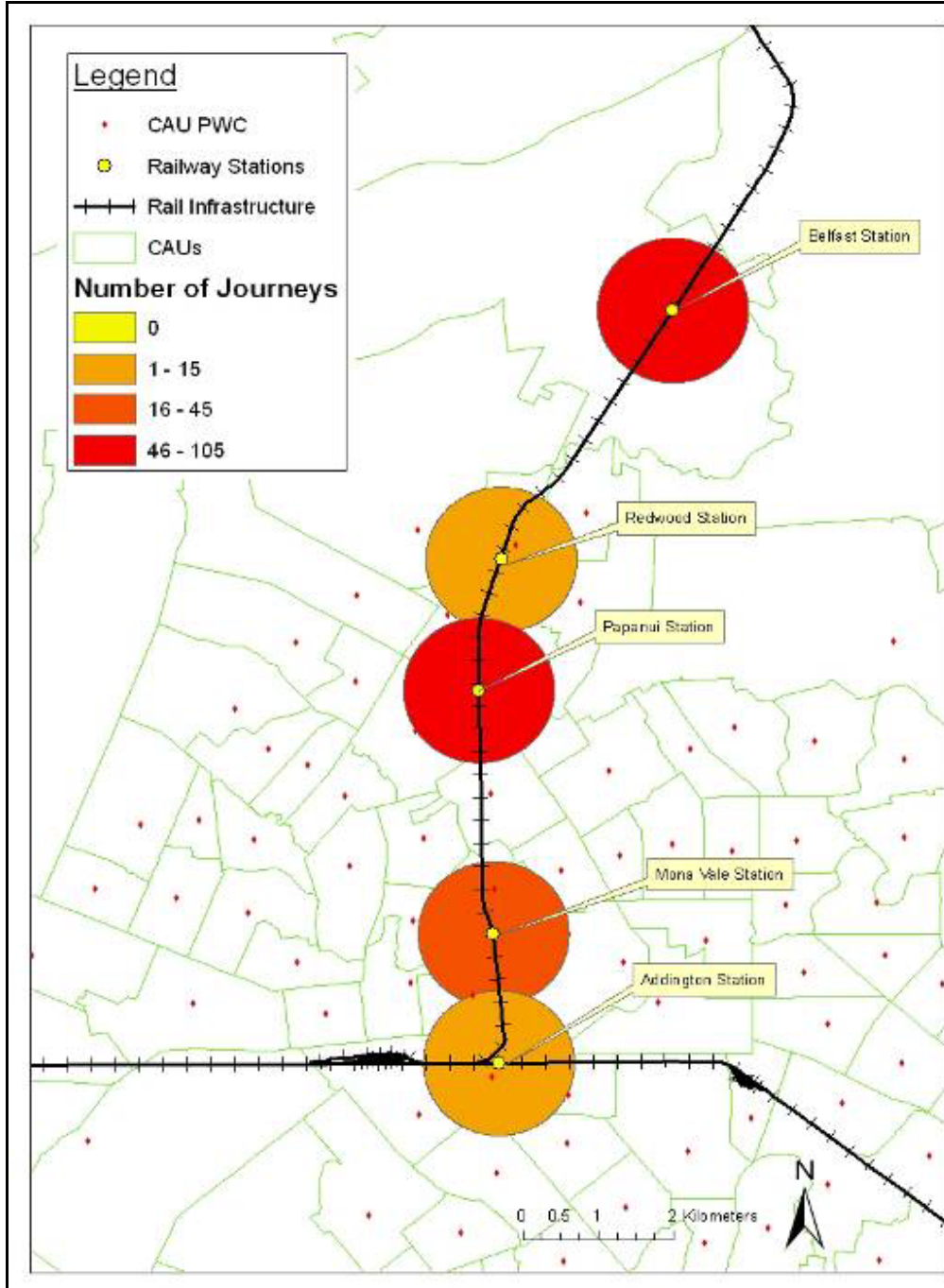


Figure 5.5: Journeys from 1km Kaiapoi Station to within 1km of identified Christchurch Station

Figure 5.6 shows journeys from within 2km of Kaiapoi Station, which includes 3 CAUs. The extra CAU included in the 2km buffer added 54 total journeys to make 363 journeys. Belfast and Papanui Stations continued to be the most popular destinations, maintaining a share from Kaiapoi 1km of around 34% and 30% of total journeys respectively for the Kaiapoi scenario

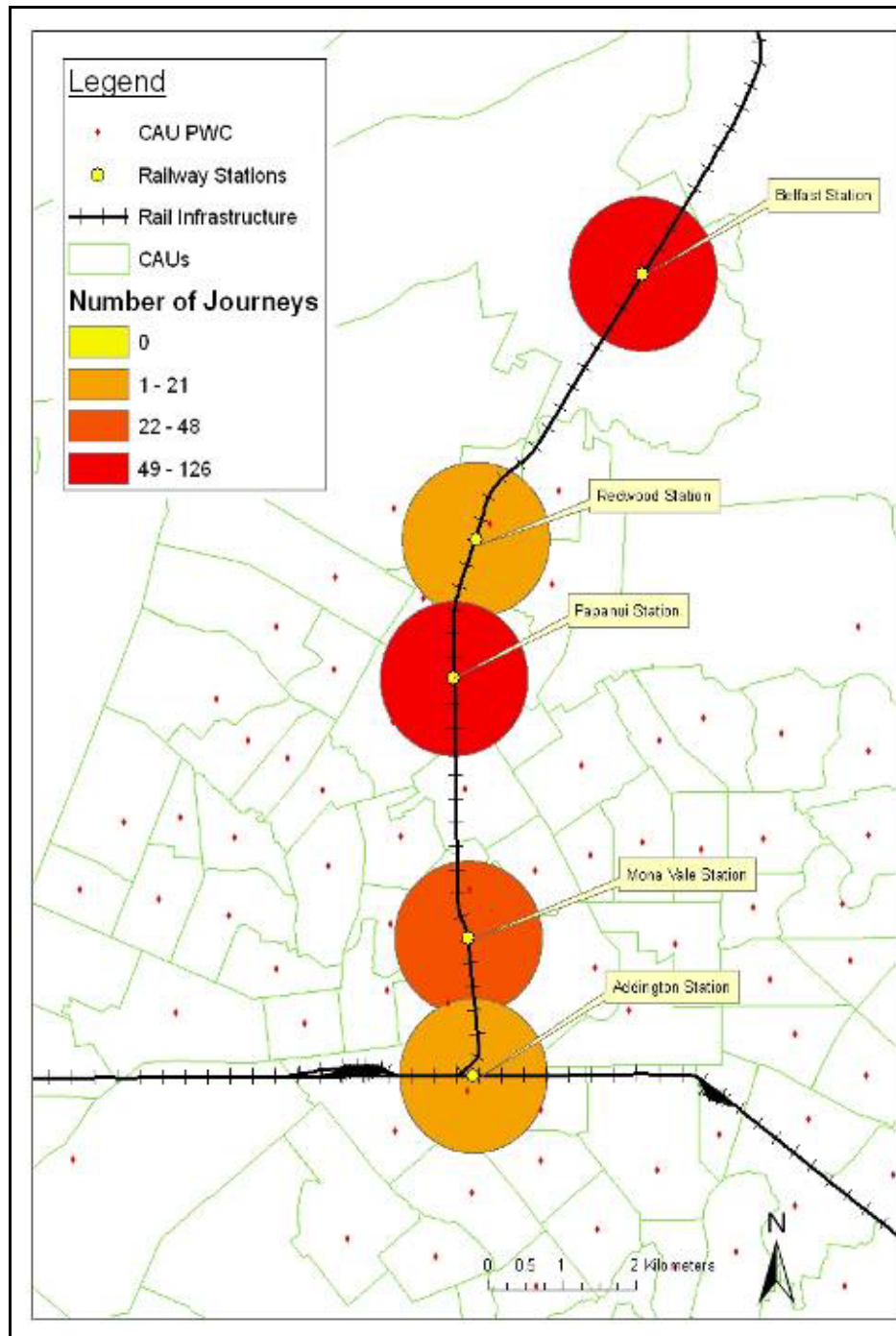


Figure 5.6: Journeys from 2km Kaiapoi Station to within 1km of identified Christchurch Stations

The greatest number of journeys is to within one kilometre of Belfast Station, representing 111 journeys or 33.7% of journeys to within 1km of stations. Redwood Station again receives a relatively low number of journeys at 15 (4.4%). The total number of journeys using 5km buffers on Rangiora and Kaiapoi Stations to within 1km of Christchurch Stations was 573, only 75 journeys more than the combined Rangiora and Kaiapoi 2km buffers. CAUs added from the 5km buffers show low numbers of people in employment (see Figure 5.1)

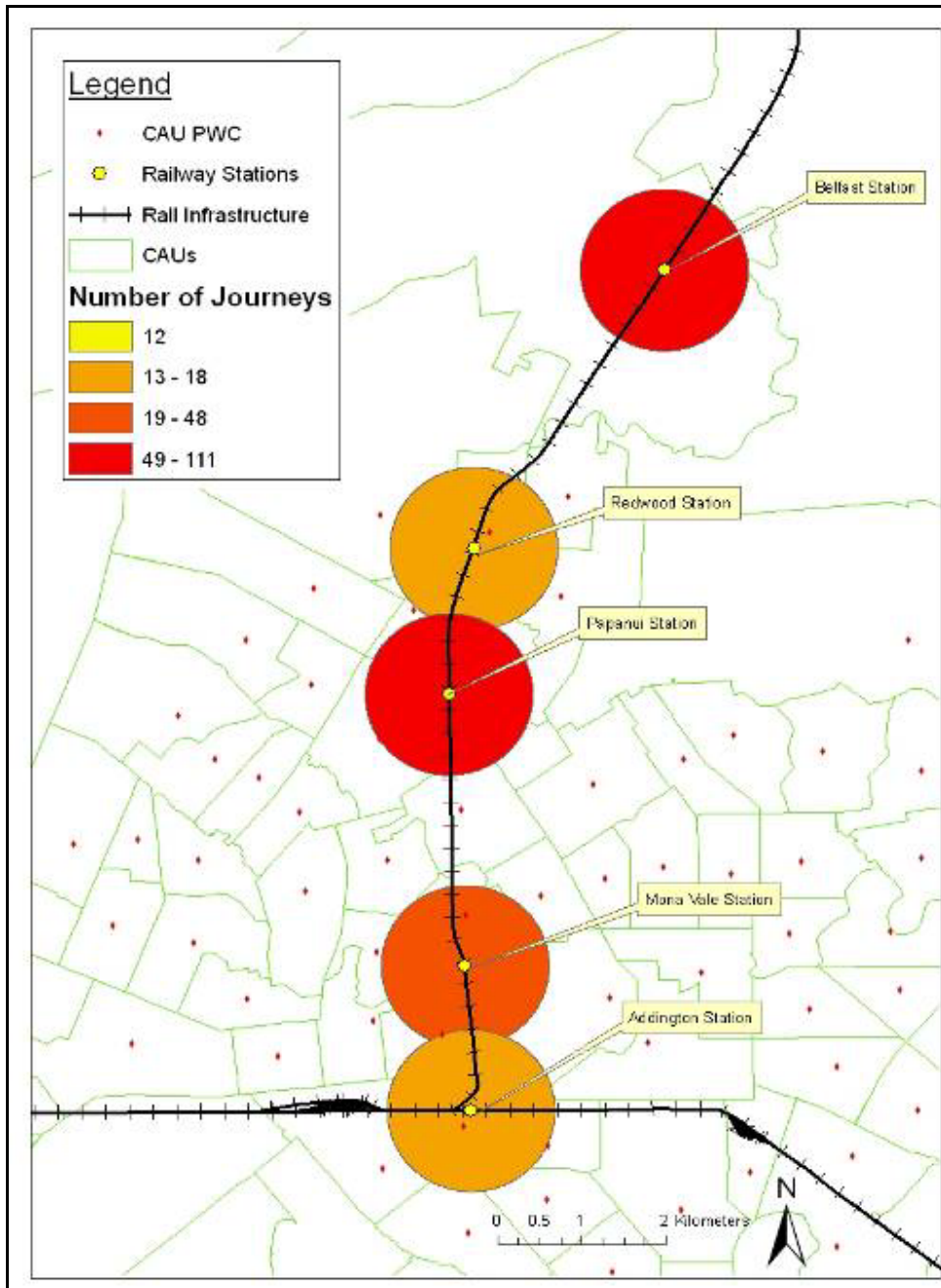


Figure 5.7: Journeys from 1km Rangiora and Kaiapoi Station to within 1km of identified Christchurch Stations

Figure 5.8 represents the total number of journeys originating in the Waimakariri District to within one kilometre of Christchurch stations. 858 total journeys were recorded for this variable with Belfast (342 journeys; 39.7%) and Papanui (261 journeys; 30.4%) making up the majority of journeys (70.1%). Mona Vale received 16%, Addington 8.7% and Redwood Station was the lowest receiving 42 journeys (4.9%)

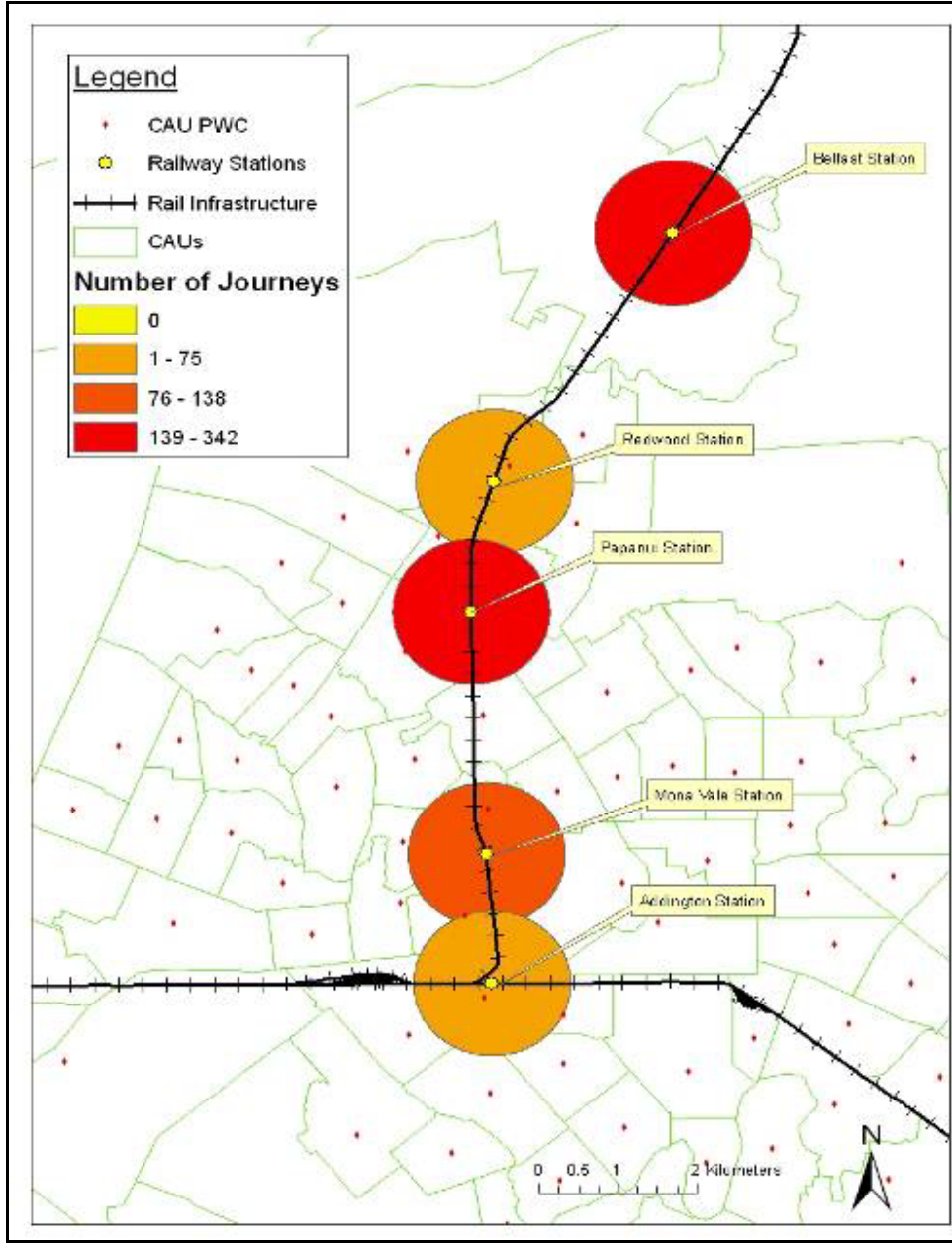


Figure 5.8: Journeys from total Waimakariri District to within 1km of identified Christchurch stations

5.22 Integration of additional and existing services

Figure 5.9 shows an all encompassing buffer of the potential coverage area that could be achieved through the combination of rail operating on the Main North Line in conjunction with current bus routes currently operating within 500m of identified stations. The Orbiter bus and the number 10 Cashmere bus are shown as examples of bus routes which were buffered and also show the locations of the bus routes which were analysed in GIS.

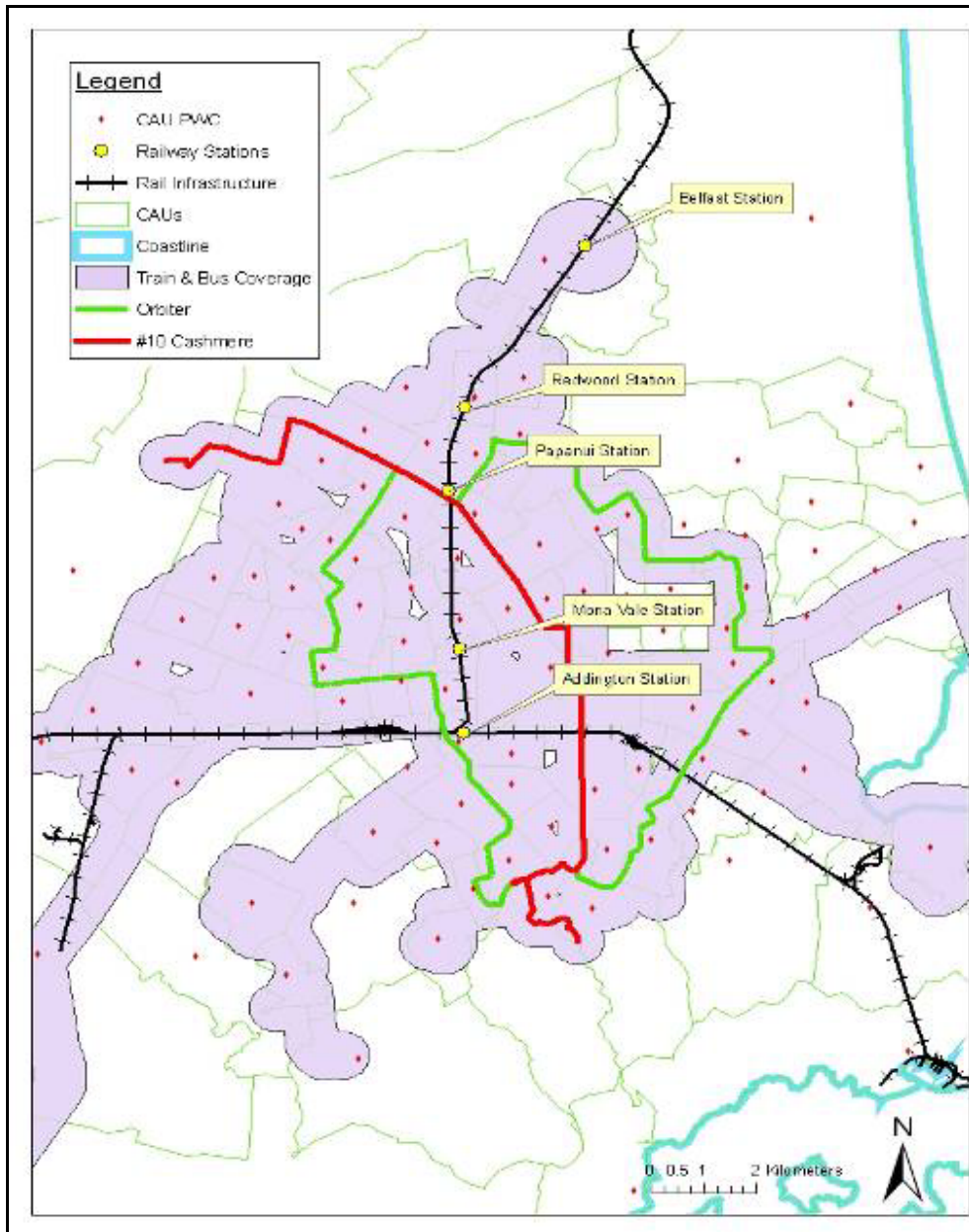


Figure 5.9: Buffer showing total coverage of passenger rail in Main North Line and current bus services within 500m of identified stations.

An analysis of additional existing services included all bus routes currently operating within 500m of railway stations. The integration of services has been shown to be successful in international settings through increasing the opportunities for people to transfer from one mode to another quickly, safely and easily. The Orbiter and Cashmere bus routes are also shown on the map as examples bus routes within 500m of a train station, displaying their route coverage and proximity to identified stations. The total amount of journeys; originating from within one kilometre of Rangiora and Kaiapoi stations and terminating in CAUs covered by 500m buffers placed around the Orbiter and the number 10 Cashmere bus routes; was analysed.

Table 5.1 shows that significantly more people who live within two kilometres of Rangiora and Kaiapoi train stations work within 500m of the Cashmere bus route when compared to the Orbiter bus route. The main reason for the Cashmere bus capturing higher numbers of journeys to work is that the Cashmere route services the Christchurch CBD where three CAUs capture 23.5% of Waimakariri District resident's employment locations. The Cashmere bus also services Christchurch Airport, a large source of employment. The orbiter route services Christchurch's four largest shopping malls as well as the University of Canterbury as well as several schools and recreational venues. Transferring to the Orbiter can occur at Papanui and Addington stations on to services running clockwise and anti-clockwise at 10 minute frequencies from 6am-7pm.

Table 5.1 Journeys from Rangiora & Kaiapoi to within 500m of Orbiter and Cashmere bus routes.

	From 1km of Rangiora	From 2km of Rangiora	From 1km of Kaiapoi	From 2km of Kaiapoi
500m of Orbiter route	24	165	228	255
500m of Cashmere route	78	519	594	651

The total number of Waimakariri District residents who could reach their place of work by using a combination of rail and bus public transport was calculated according to existing bus services and their current routes. 2334 total journeys to work from within 1km of Rangiora and Kaiapoi Stations could be completed using the combined rail (1km) and bus (500m) buffer. A total of 6051 Waimakariri District residents work within the rail and bus buffer meaning 38.6% of these journeys originate from within 1km of Rangiora and Kaiapoi Stations.

Results from the scenarios analysed through GIS are presented in table 5.2 which show that journeys based solely on rail scenarios are far lower than journeys made through a combination of rail and bus, indicating the potential of transferring from rail to bus in Christchurch. Belfast and Papanui Stations proved the busiest in terms of the amount of Waimakariri District residents working in CAUs within 1 and 2km of the stations.

Potential patronage figures are represented in table 5.3 using responses from the phone and brochure surveys indicating the proportion of people willing to switch from their current main mode of transport to rail for the journey to Christchurch. Results have been expanded upon according to predicted population growth in the Waimakariri District, revealing the potential number of journeys given the amount of growth predicted. Growth predictions are given for the modified results provided by the phone and brochure surveys also.

Table 5.2 Journeys from the Waimakariri District that could be made by public transport

	From 1km of Kaiapoi	From 2km of Kaiapoi	From 1km of Rangiora	From 2km of Rangiora	From total WD
To 1km Belfast	105	126	6	66	342
To 1km Redwood	15	21	0	9	42
To 1km Papanui	93	108	6	48	261
To 1km Mona Vale	45	48	3	33	138
To 1km Addington	15	18	3	21	75
To 1km all Stations	273	321	18	177	858
To 1km all stations and 500m of any connecting bus route	1734	1923	195	1365	6051

Table 5.3 Potential patronage based on Waimakariri District population growth (journeys per day)^

	To 1km of Christchurch Stations			To 1km of Christchurch stations or 500m of connecting bus services		
Percentage of people willing to switch to passenger rail	100%	73.5% #	69% *	100%	73.5% #	69% *
2001	858	630	592	6,051	4,447	4,175
2021 – 36% population growth	1,167	858	805	8,229	6,048	5,678
2041 – 87% population growth	1,604	1,179	1,107	11,315	8,317	7,807

73.5 % based on phone survey responses

* 69 % based on brochure survey responses

^Journeys are from total WD seen in table 5.2

Chapter Six:

Discussion

This chapter will attempt to discuss the results with reference to International literature and national and regional transport strategies currently in use.

Waimakariri District transport options will be discussed with reference to research findings and relevant issues relating to those findings.

6.1 Benefits of Passenger Rail for the Waimakariri District

The possibility of passenger rail services operating again in Canterbury has generated a lot of interest. The popularity of passenger rail is a result of rising congestion and possibly petrol costs combined with the strong historical connection between rail based services in the Canterbury region.

6.11 Maintaining Accessibility

Increases in the cost of travel, as a measure of time and money spent travelling have decreased access levels in many international urban settings, affecting the quality of life for those reliant on utilisation of connecting transport routes (Levine & Garb, 2002). Levels of access should be equal for all members of society through a range of transport options such as alternatives to the private motor-vehicle (Mees, 2000) Access levels will continue to deteriorate, as demand for current infrastructure increases as a result of restricted transport options and continued population growth.

The increased demand placed on transport routes between the Waimakariri District and Christchurch has raised access issues for the almost 7,000 Waimakariri District residents who regularly commute into Christchurch for work, not including Waimakariri District residents who attend Christchurch schools and Universities. Planning for future growth in the study area should include transport options which are equitable and sustainable as per the objectives in the New Zealand and Regional Transport Strategies (ECan, 2005a; Ministry of Transport, 2002). Peak traffic congestion between the Waimakariri District and Christchurch has become a problem due to the growth of the Waimakariri District, in particular Rangiora, Kaiapoi and Woodend, the dominance of motor-vehicle transport in the region and a lack of alternative transport options, factors that indicate low levels of accessibility and efficiency of urban transport (Bertolini et al., 2005; Levine & Garb 2002; Salomon & Mokhtarian, 1998) Growth occurred because people were willing to live in the Waimakariri District and work or attend places of education in Christchurch because it was easy to access Christchurch from Rangiora, Kaiapoi and Woodend through the use of a motor-vehicle. The Waimakariri District also provided space for increased suburbanisation; a by-product of motor-vehicle dependence (Newman & Kenworthy, 1996). Waimakariri District residents were able to develop large lifestyle properties due to land availability and cheaper residential properties on the outskirts of Christchurch.

There are several schools located in proximity to the Main North Line, shown as the black line which runs through Figure 6.1 which Waimakariri District school children would attend. Papanui High School, St

Andrews College and St Bedes College are all large high schools located within 2km of the proposed Papanui Station identified by the large outlines in Figure 6.1. There are also numerous primary and intermediate schools located in the area, shown through the smaller outlines in figure 6.1. Christchurch Girls High School and Christchurch Boys High School are located within 500m of the proposed Mona Vale Station, shown by the large outlines in Figure 6.2. It is unclear how many students live in the Waimakariri District and attend these Christchurch schools. Rangiora and Kaiapoi have respective high schools yet many families would send their children to Christchurch schools with reputations of excellence in sport and/or the quality of education.



Figure 6.2: Locations of schools in Fendalton/Riccarton region

Source: Available from: <[http:// www.ccc.govt.nz/maps/Wises](http://www.ccc.govt.nz/maps/Wises)> © Wises Publications Limited

The implementation of new public transport systems for Canterbury’s satellite towns should be concerned by the location of schools and Universities within Christchurch. School children can be a captive source of public transport patronage because they are unable to drive or cannot afford a vehicle. Parents taking their children to school in the car contribute significantly to peak hour traffic. Providing safe and affordable transport to schools can be effective in decreasing traffic congestion because it effectively cancels out two journeys (taking the child to school and the return journey home), for parents who are full-time caregivers or work at home.

A proportion of University students are also captive to public transport because they can not afford to own or operate a car. The University of Canterbury’s parking facilities are at capacity and University transport management have been pro-actively promoting sustainable transport options for accessing the campus, both for staff and student populations. The University of Canterbury is located around 1500m from the proposed Mona Vale Station, a distance that could easily be covered by bicycle but on the outer limits of a feasible walking distance. Again, the supply of a connecting bus service transferring passengers to the University is very achievable, especially with the introduction of bus priority measures in Christchurch

Transit New Zealand has plans to increase road capacities between the Waimakariri District and Christchurch on transport routes currently in high demand, while research on the feasibility of passenger rail services for Canterbury is a result of the continued demand for an increase in the transport capabilities of the Waimakariri District. Access levels can determine residential and commercial locations (Cervero, 2003), where chronic congestion increases travel times and effectively increases the distance between Christchurch and the Waimakariri District, people and businesses are less likely to locate in the Waimakariri District when they require regular travel into Christchurch. Urban development of Rangiora and Kaiapoi could be fostered by efficient transport systems linking the Waimakariri District to Christchurch which will help Canterbury accommodate forecast population growth. For example the development of Pegasus Town will also have an impact on traffic levels both within the Waimakariri District and on transport links to Christchurch and realistically efficient, sustainable transport options should also be provided.

6.12 Urban Growth

Continued high population growth within the Waimakariri District is placing increasing pressure on the transport infrastructure connecting Christchurch to the Waimakariri District, which is currently limited to road transport; while walking and cycling options are limited due to the high-speed, high capacity nature of the existing arterial routes. Traffic congestion is growing on the existing road infrastructure linking the Waimakariri District to Christchurch, particularly at peak hours of travel during the mornings and evenings.

A rail service operating on the Main North Line and on the Canterbury rail network is capable of supporting substantial increases in population densities and commercial development if the line was upgraded. High population densities are needed to support a rail system which is capable of transporting large amounts of people with high levels of efficiency compared to road based transport (Akerman & Hojer, 2005; Laird et al., 2001). The use of rail is highly effective in developing consolidated urban areas (Edwards & Mackett, 1996; Gibbons & Machin, 2005) and restricting the type of urban sprawl which can choke a regions transport system through chronic congestion. There is potential for the Waimakariri District to carefully plan an integrated approach for continued growth and sustainable transport options.

Transport options can have a strong influence on urban growth and therefore the planning of transport should be integrated into urban planning. The Greater Christchurch Urban Development Strategy provided a forum which discussed the style of urban planning required to accommodate forecast population growth. 63 per cent of forum responses favoured urban consolidation covered by UDS Option A as described in section 3.21 and displayed in Figure 3.2 (UDS, 2005). Urban growth for the Waimakariri District under Option A would be consolidated growth in Kaiapoi, Rangiora and the soon to be developed Pegasus Town. Concentrated growth in these areas would support a rail based passenger transport system with stations

located in Kaiapoi and Rangiora as submissions mentioning the need for passenger rail was identified as a common theme among submitters (UDS, 2005). Consolidation of urban areas increases population densities, increasing the level of support for a potential rail passenger service (Laird et al., 2001; Mees, 2000). As mentioned train stations and services are also capable of increasing urban densities, further increasing the long-term success of the service.

Allowing dispersal within the Waimakariri District could place even more pressure on transport networks within the district and on connecting links to Christchurch and make providing public transport options difficult (Cervero, 2003). Concentrating development within already established urban settlements such as Rangiora and Kaiapoi and Woodend and the future Pegasus Town development could provide attractive residential options for a growing Canterbury population if efficient transport options are also provided. Basing urban planning around transport can ensure transport systems match the urban environment and are efficient.

6.13 Transport Equity

Due to the rural nature of much of the Waimakariri District, transport by way of private motor-vehicle is by far the most dominant form of transport for travel within the district. As has been discussed, travel from the Waimakariri District to Christchurch is dominated by car travel. The brochure survey conducted found that only 2% of residents who commute into Christchurch cycle or walk. The distances and lack of safe walkways makes walking from Kaiapoi into Christchurch virtually impossible. The construction of a safe cycle-way constructed independently from the road system would make cycling from Rangiora and Kaiapoi into Christchurch a feasible journey. The brochure survey found that just over 20% of residents who regularly commute into Christchurch do so by way of current bus services, which is a very high modal share for bus. Public transport modal shares for the journey to work in Christchurch were recorded at 14% from the 2001 Census (Environment Canterbury, 2005d).

The Environment Canterbury brochure was designed to investigate the resident reception of a bus upgrade for the Waimakariri District, given the low level of current service and may have therefore attracted responses from those using the current bus service hoping to receive a better service. The low feasibility of Waimakariri District residents walking or cycling into Christchurch may also increase reliance on current public transport services.

Improving public transport services for the Waimakariri District could attract a greater modal share for regular commuters into Christchurch by providing for those who can not own or drive a motor-vehicle (Mees, 2000). Given that cycling and walking current routes is difficult, Waimakariri District public transport levels should be higher than those for Christchurch. Rising petrol costs has made regular commuting from the Waimakariri District an increasingly expensive operation which will be affecting

those on tight budgets. Affordable public transport alternatives are needed to ensure the transport system is equitable (Viegas, 2001).

Running bus services on existing, increasingly congested roads linking the Waimakariri District to Christchurch decreases the level of service provided. Bus services are subject to congestion levels and travel speeds are decreased as the bus pulls in and out of the traffic flow. The implementation of bus lanes would increase the level of service a bus system could provide by increasing travel speeds and decreasing travel times for those reliant on public transport and also making the service attractive to those currently dependent on their cars.

The price of petrol in New Zealand has risen by around 36% from 2003 to 2006 increasing the total cost of operating a motor-vehicle and impacting on Waimakariri District residents who rely on their vehicle to commute daily into Christchurch. The cost of operating a vehicle was calculated using New Zealand Automobile Association (AA) research findings to determine how much Waimakariri District residents are paying to drive to Christchurch. The AA provides estimates of running costs based on brand new vehicles using engine sizes ranging from up to 1300cc to over 2000cc (Appendix B). New cars may incur more capital investment but will be more likely to run efficiently and will incur less value depreciation than the purchase of second hand cars. The engine size used for analysis in table 6.1 was for a 1601-2000cc sized engine used as the middle range of those provided by the AA study.

Factors included in the detailing of operating costs include fixed costs such as annual licensing, insurance and depreciation and running costs including petrol, oil, tyres, repairs and maintenance. Petrol prices were based on petrol prices of January 2003 when regular octane petrol cost \$1.09 per litre. Petrol prices are currently around \$1.68 a litre and are only expected to continue to rise. AA fixed and operating costs for 2006 were calculated using 2006 petrol prices which equated to 73.7c per km and 2006 petrol costs were used to calculate operating costs based on petrol use only.

Table 6.1 Costs for return car journeys from Rangiora and Kaiapoi

FROM RANGIORA	Distance	AA 2003 Costs (68.6c per km)	AA 2006 Costs (73.7c per km)	2006 Petrol only (14.4c per km)
Belfast	35.2km*	\$24.15	\$25.94	\$5.07
Papanui	46.4km*	\$31.83	\$34.20	\$6.68
Christchurch CBD	55km*	\$37.73	\$40.53	\$7.92
Christchurch Airport	55.6km*	\$38.14	\$40.98	\$8.01
FROM KAIAPOI				
Belfast	15.6km*	\$10.70	\$11.50	\$2.25
Papanui	26.8km*	\$18.38	\$19.75	\$3.86
Christchurch CBD	35.4km*	\$24.28	\$26.09	\$5.10
Christchurch Airport	36km*	\$24.70	\$26.53	\$5.18

Source: Adapted from AA research available at www.gosmarter.org.nz.

*Journey distances are for return trips

Car operating costs could provide some indication of potential rail passenger fares. Return journeys from Rangiora to the Christchurch CBD came out at around \$38, which provides plenty of room for a return rail fare, even with the provision of a transfer service to be well under this price. Rail fares would need to be below car operating costs to be a more attractive transport option and change travel behaviour. Many people however, only consider the cost of operating a vehicle as the weekly amount spent on petrol. Few people consider the cost of depreciation or annual licensing, or even the initial purchase of the vehicle once it is in their possession. Operating costs are around 500 per cent more, compared to just petrol costs when all the costs associated with operating a vehicle are taken into account. The fact remains that increasing car operating costs through rising petrol prices is having an impact on travel decisions and therefore will be increasing the viability of passenger rail and the level of fares which could be justifiably set by potential rail operators.

6.2 Feasibility of Passenger Rail for the Waimakariri District

6.21 National and Regional Stances

The National Rail Strategy 2005-2015 (NRS) reveals that rail is rising as a national transport priority. New Zealand has a strong rail history and current national policy recognises the versatility rail corridors provide for the sustainable transportation of both passengers and freight. Increased use of rail decreases national dependence on petroleum, a global resource that is becoming highly contested and increasingly valuable.

Government funding continues to support passenger rail in Wellington and Auckland and there is specific mention of investigation into rail services for Hamilton and Christchurch (Ministry of Transport, 2005b)

The National stance on rail is now bright. Development of passenger rail services in Auckland is attempting to catch up to progress which should have been made possibly a decade earlier. Auckland is now a sprawling city with rail lines which are not easily accessed by the residential population and the required investment is now higher than it could have been if planning for the increased modal share for passenger rail had occurred years earlier. Auckland's chronic traffic congestion indicates the (un)sustainability of motor-vehicle dominance and the role rail can provide in providing efficient and equitable transport systems. .

Christchurch and Canterbury can learn from Auckland's lack of urban development and transport planning and incorporate rail passenger transport into the future of both. The long-term benefits of a high quality rail service linking Christchurch to Kaiapoi, Rangiora, Amberley and Waipara are sustainable transport and growth for the Waimakariri District, which benefits the entire Canterbury region. The initial investment in a high quality system is however a major hurdle. Environment Canterbury (ECan) at this stage is reluctant to show any commitment to rail development. Current attempts by ECan to improve bus services for the region require local support for implementation of the changes. Simultaneous promotion of passenger rail by ECan would confuse Waimakariri District residents and possibly undermine current passenger transport strategies (improving bus services). The timing of this research has therefore conflicted with the current regional stance and agenda of Environment Canterbury; which as a result has hindered the research process.

Regional research by ECan on regional passenger rail has currently included discussions of the various options available and the level of service each option would provide and a rough costing estimate by GHD for the options identified. Furthermore ONTRACK has met with Environment Canterbury to discuss funding for potential projects. ONTRACK responded by stating that "ECan's initiative is consistent with the objectives of the National Rail Strategy" (ONTRACK, 2005;pg 17) going on to state that "the government would cover 60% of the costs of buying rolling stock and extending infrastructure.....if proposals are incorporated into a Regional Land Transport Strategy" (ONTRACK, 2005;pg 17). Progress is being made and bodes well for the future success of passenger rail for Canterbury; the only question remaining is how long it will take to get services up and running.

A report commissioned by ECan and conducted by Sinclair Knight Merz (SKM) in 2004 stated that current bus services could be improved to increase public transport modal shares and provide short to medium term solutions to regional traffic problems, while it was advised that the retention of existing rail corridors for future implementation of passenger rail services was a long-term transport option. The SKM

advised the use of bus priority to increase the efficiency of bus services, bringing journey times closer to those of car journeys, thereby increasing the attractiveness of the bus network (SKM, 2004). Already bus priority routes are being introduced to Christchurch streets. Figure 3.2 provides an example of one of the proposed bus lanes which will hopefully be implemented in 2006 by the Christchurch City Council (CCC, 2005). Papanui Station would be located between Langdons Road and Harewood Road. The proposed bus lane in Figure 6.3 could provide a transfer service from Papanui directly to the Christchurch CBD along Papanui Road. There are several bus services identified by the CCC which would benefit from this particular bus lane. These buses could also provide a number of transfer options for rail passengers at Papanui Station.

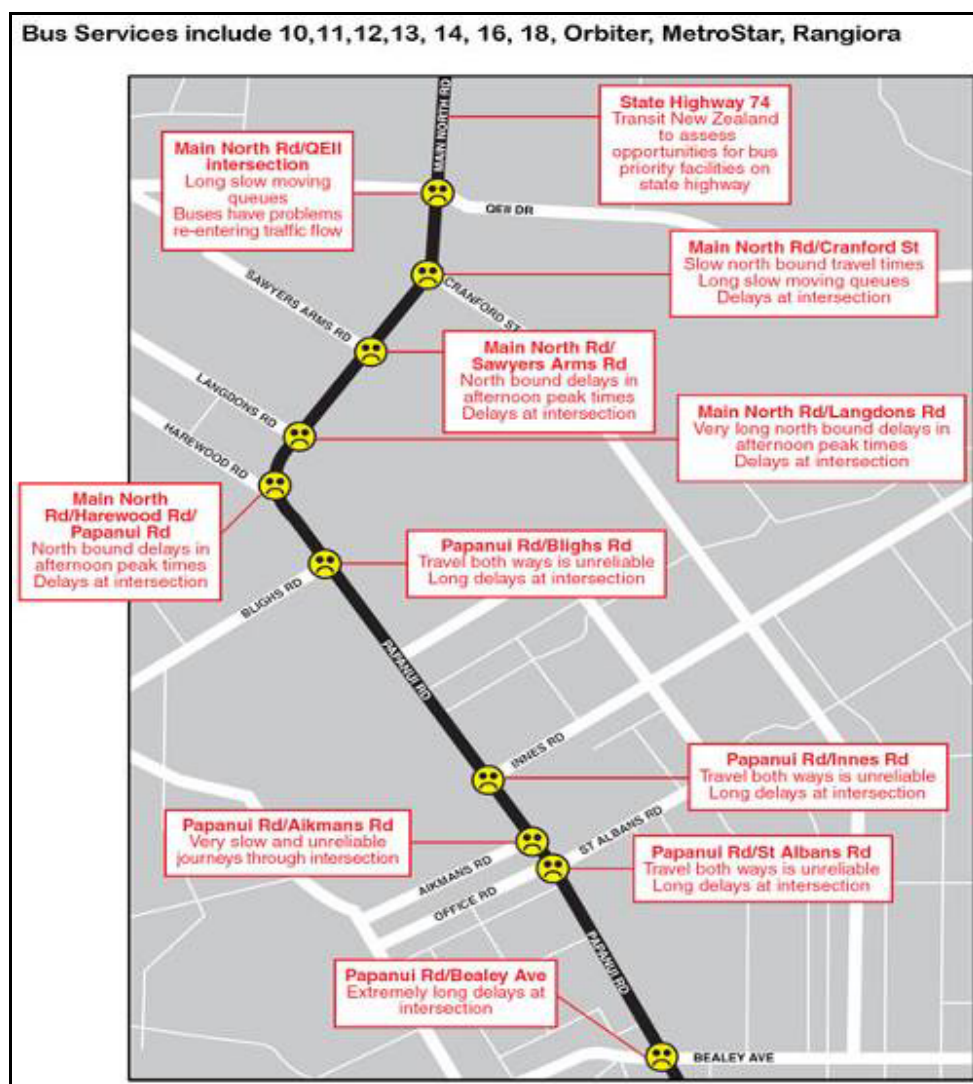


Figure 6.3: Introduction of bus lanes for Main North Road and Papanui Road

Source: Available from: <[http:// www.ccc.govt.nz](http://www.ccc.govt.nz) >

6.22 Limitations of Methodology

One of the aims of this rail feasibility study was to investigate the travel patterns of Waimakariri District residents through surveys and journey to work data. However co-operation with ECan in an attempt to identify a sample of residents' home and work addresses proved difficult due to confidentiality concerns and a conflict of agendas. Research occurred during a time when passenger rail was heavily publicized in the media and portrayed as the answer to Christchurch's growing transport problems. The political nature of transport policy made assessing resident travel behaviour difficult due to the quality of data received. Results from surveys organised by Environment Canterbury did not include accurate locations for residential addresses and workplaces as required. It was initially planned to plot the origin and destinations points of a sample of Waimakariri District residents who worked in Christchurch based on distance from potential train stations using GIS. The accurate locations of residence and work would be needed to accurately plot a sample of Waimakariri District residents' travel needs.

The use of CAUs to analyse journey to work data was problematic, however it was the only form of data available for the purposes of this research. The irregular shape and size of the CAUs made it difficult to investigate distance from the proposed train stations. The use of population weighted centroids (PWC) was useful for considering the location of urban development within the CAU. However, several CAUs were either just included or just missed out on selection according to the exact location of the PWC, even though large parts of the CAU were within the buffer (See figure 4.2). A certain amount of balancing will have occurred for CAUs which were just included or just missed out but due to high employment variations within CAUs, although it is unclear how well balanced this method was, therefore the accuracy of GIS analysis is in turn hindered by data which was spatially, not well detailed.

The maximum distance used for people transferring from train to bus and then walking to work was 500m. The literature states that 2km is the longest distance people will walk to get to train stations (Gibbons & Machin, 2005), and that 500m was around the average distance walking distance (Kuby et al., 2004). It was therefore assumed that people would not walk more than 500m at the destination end of their journey after going through the journey process of: getting to a station, changing modes at a train station, and then walking a considerable distance to reach their workplace.

The phone and brochure surveys asked questions on Waimakariri District residents' willingness to switch to rail for their main mode of transport for the trip into Christchurch, which is known as a stated preference. The actual number of people who end up using a service is known as the revealed preference and can be compared to the stated preference. Literature on stated versus revealed preferences discusses the uncertainty surrounding what people say they will do and whether they will actually do it. There appears to trends among public transport surveys of respondents over committing to alternative modes of transport such as rail and bus, especially new bus services (Louviere et al., 2000).

The cost of petrol is an important variable in determining individual travel behaviour as well as urban transport systems. As petrol prices continue to rise in New Zealand, people are looking more towards alternative modes of transport such as cycling or public transport. The unpredictable nature of petrol price fluctuations will continue to be a local and global issue. It is unclear if petrol prices will keep rising in New Zealand or if they do rise, how much will petrol cost before residents demand cheaper, alternative modes of transport.

Population growth in the Waimakariri District is also fairly unpredictable. The UDS population predictions include low, medium and high predictions for population growth which are around 10,000 potential residents below predictions based on 2001 census data found on the Waimakariri District Council website (WDC, 2003), due to the fact that census data is based on estimated resident populations as opposed to usually resident population (Statistics New Zealand, 2001). Both predictions indicate the level of variation for population predictions. Predictions based on census data also vary by 10,000 from low to high growth levels for the Waimakariri District (WDC, 2003), which is a considerable number of potential residents. Population predictions used in table 5.3 are medium levels growth based on the usually resident population predictions used by the UDS group. Variations in population predictions and the unpredictability of figures generated therefore limits the accuracy of predicting future potential patronage levels.

6.23 Potential Patronage Levels

Vocal demand for a rail passenger service operating in the Waimakariri District has arisen due to number of reasons. Growth in the region has placed too much demand on existing road infrastructure and road journeys, particularly during peak periods of commuting to work are taking an increasing amount of time. Rail infrastructure is in proximity to Rangiora and Kaiapoi and residents are well aware of the Main North Line because it runs almost parallel to the arterial routes connecting Rangiora to Kaiapoi and into Christchurch across the Waimakariri River. Residents stuck in traffic, particularly on Lineside Road, notice the Main North Line and will be aware it is relatively underused. Also, current public transport services for the Waimakariri District are of a low level of service. On a basic level, using the Main North Line for passenger travel seems entirely feasible. However as has been discussed there are several factors which must be considered before investment into a passenger rail service proceeds. Most importantly the travel needs of the region; where people need to go and where they come from.

The number of forecast journeys from the Waimakariri District to within 1km of railway stations in Christchurch were fairly low (630-592) compared to journeys to within 1km of stations and 500m of a connecting bus service (6,051-4,175). It must be mentioned that some journeys using a combination of bus and rail would not be impractical for commuters due to inefficient journey paths using current bus services. Modifications could be made to bus routes to interact with passenger rail and efficiently service areas that

require high levels of access, such as Christchurch Airport. Predicted population growth was used to estimate potential patronage in 2021 and 2041 for both scenarios covered in table 5.3.

Table 5.3 in the results section shows potential patronage figures for the Waimakariri District based on 2001 Census data. The number of journeys was calculated under the presumption that everyone would switch to rail (100%) and stated preference for rail from the phone (73.5%) and brochure surveys (69%) responses. Literature on stated preference (SP) versus revealed preference (RP) can be complex and involve advanced mathematics. One of the themes that arise from SP versus RP literature is that consumer evaluations of modes alternative to the car are less reliable than evaluations of car use (Louviere et al., 2000). An Edwards & Mackett study argued that forecast patronage levels for new rail systems have been well below actual levels once the system is in place, but places blame on government organisations making forecasts which exaggerate the impact a rail system will have (Edwards & Mackett, 1998). The proportion of Waimakariri District respondents willing to switch to rail from their current mode of transport seems high but is a reflection of the rapidly declining levels of access for residents in the area. While the number of people who actual use the service may be lower than the average 71.25% SP from the two surveys, this proportion could be achieved or increased through the integration of urban development and transport options with respect to forecast population growth in the study area as covered by the UDS. Urban planning combined with an efficient service could be used in the Waimakariri District to ensure the impact of passenger rail met expectations.

The Urban Development Strategy (UDS) predicts growth for the Waimakariri District at 36% at 2021 and 87% at 2041 from 2001 population figures (UDS, 2005). The impact this would have on potential patronage for passenger rail is significant (see Table 5.3). Firstly it increases the number of potential rail journeys to be made from the Waimakariri District to Christchurch and secondly, if this population growth was centered on Rangiora, Kaiapoi, Woodend and Pegasus Town more people would have easy access to train stations located in Rangiora and Kaiapoi, raising the proportion of Waimakariri District residents who could feasibly use the service.

UDS predictions also include increases in road congestion for Canterbury's arterial routes. Unless more than \$2 billion is spent on increasing road capacities, congestion levels are predicted to increase by 40% by 2021 and 320% by 2041 (UDS, 2005). As discussed routes connecting the Waimakariri District are already congested, meaning predicted increases would impact these routes more than others. Congestion represents an overload on parts of the transport system (Stopher, 20004) and does rail a favour by making it a more viable transport alternative in the eyes of Waimakariri District residents. Congestion decreases travel speeds and increases journey time for travel by car making alternative transport options which operate separate from the road network or with priority space increasingly attractive. People willing to regularly use passenger rail for the commute into Christchurch would be likely to increase as congestion levels

continue to rise. Increasing congestion coupled with population increases would therefore increase demand for a passenger rail service operating in Canterbury. Evidence of congestion increasing rail patronage has been witnessed in Auckland, where a 39.4% increase in rail journeys has been recorded in one year (Scoop, 2006), as rail services continue to improve in a city notorious for its traffic congestion.

The development of Pegasus Town also affects potential rail transport options for the Waimakariri District. The development is a large project, designed to provide housing for over 5,000 residents (see Figures 6.4 and 6.5). The development is aimed at people in medium to high socio-economic brackets. Section prices are high due to the range of facilities offered such as a yacht club, golf course and aquatic centre. People who will be living in Pegasus Town are likely to work in Christchurch and rely on their motor-vehicles for the commuter journey. Efficient alternative transport options would be needed for Pegasus Town residents to use them. The planned layout of the development includes a ring road running around the development which could be used by a shuttle bus entering the town from State Highway 1 and completing a loop on access roads within the development (see Figure 6.5), picking up residents and taking them to the nearest train station in Rangiora. Shuttle buses could then also pick up residents in Woodend, on the way to Rangiora where a train service would be waiting to take those people into Christchurch. Shuttle feeders could also be used in Rangiora and Kaiapoi, picking up residents and taking them to waiting trains headed to Christchurch. This type of service would significantly increase the coverage of the train stations by including people who currently believe they live too far from the station to use a passenger rail service, thereby increasing the number of potential passengers.

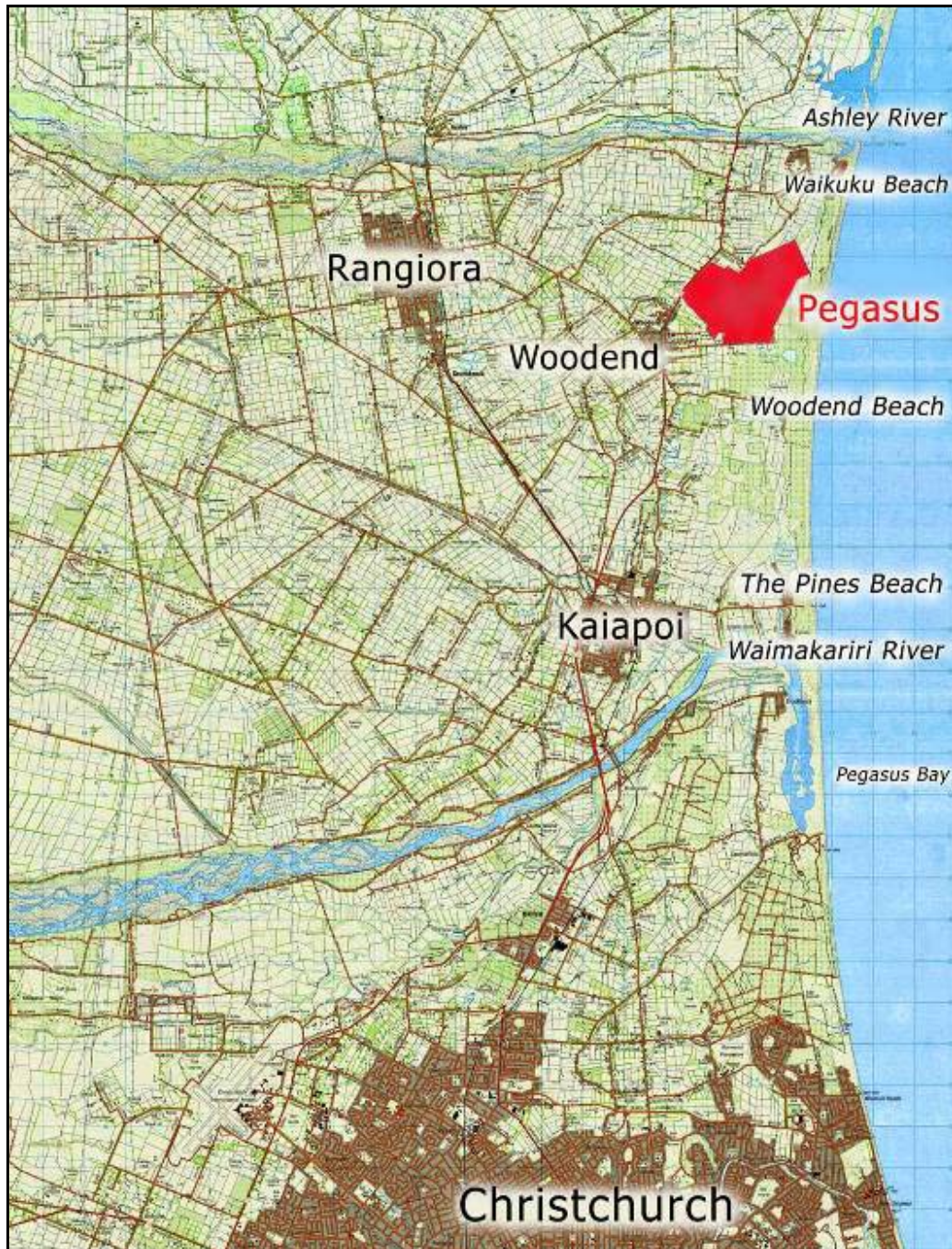


Figure 6.4: Pegasus Town in relation to Rangiora, Kaiapoi and Christchurch

Source: Available from: <<http://www.pegasustown.com>>



Figure 6.5: Master plan of the Pegasus Bay Township with roads shown in grey and residential properties in yellow. Access from State Highway 1 at the North East corner

Source: Available from:<<http://www.pegasustown.com>>

6.24 Current Limitations of Infrastructure

The quality or level of service a public transport system provides can determine the success of the system in attracting adequate patronage and being economically sustainable. The careful integration of different modes of public transport can provide a system which is accessible and provides service to a wide range of destinations. High service frequencies (5-15 minute headways) also attract patronage because people do not need to have knowledge of timetables or wait for long periods of time for a service to arrive (Jefferson, 1996; Mees, 2000).

The current state of the Main North Line provides limited options for the operation of a high frequency passenger rail service utilising the existing infrastructure and signalling system. The Main North Line is single track and has the most basic form of signalling north of Belfast. Current use of the line places pressure on the timing of a limited service during the morning and evenings. There are sidings near Redwood which allow one service to wait for another to pass but careful timing would be needed to prevent delays for passengers. The construction of a section of track at the junction of the Main North, Midland and Main South lines would be essential.

Upgrading the Main North Line to double track and improved signalling to provide a reasonable frequent service would be at a large cost. There is currently a cycle lane which is part of the rail corridor that would be removed or reduced in width to allow for the construction of a new line. The construction of railways stations would also be costly. Existing concrete platforms at proposed station sites could be utilized, although structures are decades old, may be structurally unsound or unsuitable for use depending on the exact location of the station and the rolling stock used. There appears to be adequate space for the construction of stations at all of the sites selected

The locations of current rail infrastructure as well as the potential locations of new train stations and park and ride facilities is an important consideration. Train stations are ideally located within highly populated urban densities to decrease dependence on private motor-vehicles in the area and to support the service itself. Stations can attract residential and commercial development on the grounds that the area around the stations is easily accessible. The locations for construction of new stations should provide for residents by being located near as many major urban destinations as possible, such as schools, universities and major sources of employment.

The location of Canterbury's actual rail infrastructure were deemed to be "not ideally placed to serve a significant proportion of urban travel demand" (SKM, 2004; pg 1) by a 2004 report. The main problem with any service operating on any of the current lines is lack of access to the Christchurch Central Business District, which is a major source of employment and recreation. One of the costing options identified by ECan involved an underground train route to the Christchurch CBD; however the cost of such a project can not be justified by current population densities, even within Christchurch City. The integration of another mode of public transport with rail, presumably a bus service, would be needed to transfer people to town. There are currently a number of high frequency services which run near the locations of proposed stations which terminate in the Christchurch CBD. There is also the possibility of the construction of a tram service running through Hagley Park to the CBD which passengers could instantly transfer to. The introduction of bus priority lanes in Christchurch (see Figure 6.1) would decrease total travel times involved in a journey involving transferring and increase the coverage and attractiveness of the initial rail service.

6.3 Options for the future

6.31 The cost of upgrading

Transport capacities on routes connecting the Waimakariri District to Christchurch need to be increased within the next 10 years. Current road arteries between Christchurch and the Waimakariri District are unable to cope with current growth levels in the Waimakariri District especially with the completion of the Pegasus Bay development within the next 5 years. Comparing the total costs associated with the development of rail (and bus) passenger services to the cost of increasing road capacities is a valid consideration, but difficult to calculate. There are various options involved for each mode and options chosen for road and rail will dictate the amount of investment required.

Environment Canterbury have organised research into the various costs of potential passenger transport options for the Canterbury region which are shown in table 3.3. The costing study conducted by GHD revealed that a high level of service, meaning high frequencies, new rolling stock and train stations is an expensive investment in the region's transport network. GHD costing estimates are based on overseas investment in rail services which provide very high levels of service. As a result the cost estimates provided by GHD are at the upper end of cost estimates. Cheaper options could be available and examples of cheaper alternatives have been provided by individual researchers interested in the development of rail options for Christchurch.

The cheaper options identified revolve around the purchase or purpose built construction of light rail rolling stock similar to a bus on rails (NZ Herald, 1997), which would cost significantly less than traditional refurbished or new diesel units used in expensive overseas investments. Lightweight rail based options are purposefully designed to be cheaper than traditional light rail systems and have been reported to have capital and operating costs at 40-60 per cent lower than the traditional systems (Greater Christchurch UDS, 2006). The lightweight alternatives focus on the notion of having a lot of small compact units instead of fewer large units. Frequencies can be increased because units are easier to fill and track construction is cheaper and more versatile due to the light weight nature of the units (Greater Christchurch UDS, 2006). This type of ultra-light system could provide transport over Hagley Park from the Main North Line into the Christchurch CBD as well as a number of connecting services feeding off Canterbury's main 'heavy rail' corridors.

The amount of revenue which a passenger rail system servicing the study area could generate is interesting when discussing the cost of implementing a new rail service. Passenger rail fares will vary for different areas of the Waimakariri District and would need to cover the full cost of a return journey including transfers from feeder services at either end of the journey. Car operating costs covered in table 6.1 provide an indication of the level of fares which could be set. Table 6.2 shows how much revenue could be generated per day and for a working year based on between 250 and 300 working days. It must be

mentioned that passenger numbers may be lower on weekends and public holidays; although there is the possibility for a rail service operator to run recreational and tourist based services on these days, which could supplement revenue (Roger Sutherland, pers comm. 2005) Table 6.2 is used only as an estimate. Operating costs would be determined by the level and type of service provided.

Table 6.2 Potential revenue generated using possible patronage figures and fares

Journeys	Price*	People per day				
		600	1,000	2,000	3,000	4,000
1	\$6	\$3,600	\$6,000	\$12,000	\$18,000	\$24,000
1	\$10	\$6,000	\$10,000	\$20,000	\$30,000	\$40,000
1	\$15	\$9,000	\$15,000	\$30,000	\$45,000	\$60,000
1	\$20	\$12,000	\$20,000	\$40,000	\$60,000	\$80,000
250	\$6	\$900,000	\$1,500,000	\$3,000,000	\$4,500,000	\$6,000,000
250	\$10	\$1,500,000	\$2,500,000	\$5,000,000	\$7,500,000	\$10,000,000
250	\$15	\$2,250,000	\$3,750,000	\$7,500,000	\$11,250,000	\$15,000,000
250	\$20	\$3,000,000	\$5,000,000	\$10,000,000	\$15,000,000	\$20,000,000
300	\$6	\$1,080,000	\$1,800,000	\$3,600,000	\$5,400,000	\$7,200,000
300	\$10	\$1,800,000	\$3,000,000	\$6,000,000	\$9,000,000	\$12,000,000
300	\$15	\$2,700,000	\$4,500,000	\$9,000,000	\$13,500,000	\$18,000,000
300	\$20	\$3,600,000	\$6,000,000	\$12,000,000	\$18,000,000	\$24,000,000

* per return journey

6.32 The Alternatives to Rail

As well as alternatives to traditional light and heavy rail systems, there are alternatives to rail or track based forms of transport entirely. These alternatives to rail however, should be considered short term solutions, meaning within a 5-10 year time frame. Any long-term solutions should involve the use of some form of rail in Canterbury's transport network, particularly use of existing rail corridors. Increasing the short-term level of public transport for the Waimakariri District and Christchurch is a current ECan objective, currently in the form of a potential upgraded bus service for the area.

A recent study conducted by Sinclair Knight Merz (SKM) in 2004 which assessed the current public transport system and future public transport options for Christchurch, including the Waimakariri District. The main findings of the report states that "the existing rail lines are not ideally placed to serve a significant proportion of urban travel demand" (SKM, 2004; pg 1) and provides support for focus group comments by stating that "Christchurch railway station is too far removed from the CBD in its current location" (SKM, 2004; pg1). One of the report's main findings is that the current bus system could be significantly improved as a medium-term solution to improving public transport (SKM, 2004). The recent bus priority route proposals will contribute enormously to improvement on the current bus system. The upgrade and

expansion of the central Christchurch bus depot is also needed within the next 2 years. The report states that increasing bus priority through the introduction of bus lanes, bus-ways and more frequent services could occur before passenger rail is needed, but that existing rail corridors should be protected to provide high volume transport options in the long-term (SKM, 2004)

With specific reference to the Waimakariri District, the SKM report identifies the high rate of development occurring in the area and the significant traffic demand for the Main North Road, which links Rangiora and Kaiapoi to Christchurch via the Northern Motorway. Already bus priority measures have targeted the high level of demand currently placed on Main North Road and the Northern Motorway. Figure 6.3 shows the proposal for bus priority along Main North Road and mentions that Transit NZ is looking into bus priorities for the main state highway connecting the Waimakariri District to Christchurch. These measures will be well received by Waimakariri District residents who rely on public transport. A combination of improved bus services and bus priority routes would dramatically improve the level of service on offer.

Chapter Seven:

Conclusions and

Recommendations

*This chapter provides a brief summary of the research and
the main conclusions that came from it.*

*Theses conclusions will be discussed with regard to the
original aims and objectives.*

7.1 Overall aims concluded

7.11 Review the international literature on efficient and sustainable transport

Objectives of this aim were to review the impacts transport systems have on society, economy and the environment with respect to regional, national and global transport trends. In addition to the evaluation of transport modes and the roles they play in contributing to national and regional urban transport systems.

In the latter half of the 20th Century, the evolution of transport systems in many developed cities saw private transport supersede public transport systems as the dominant form of transport. Now, at the beginning of the 21st Century urban transport systems are feeling the strain of growing populations coupled with the popularity, or induced dependence, on private motor-vehicles. These cities are now forced to confront growing traffic congestion and urban transport systems with a variety of transport policies designed to increase the sustainability of their resident's transport needs.

One of the most effective transport policies cited in the international literature, is a return to mass public transport as part of an integrated and sustainable transport system. The capabilities of passenger rail are well signposted through the documentation of the successful implementation of rail services in Australian, United Kingdom and European cities. Quite simply rail is documented as the most efficient way of transporting large numbers of people. Without these numbers however, the implementation of new rail systems is most problematic.

Rail is not a flexible transport option. Rail lines operate best on high density, high demand transport corridors. There is widespread documentation of the problems involved with providing passenger rail services for urban populations, dispersed because of widespread access to private vehicles, which in turn increases total dependence on road infrastructures and private vehicles. The dispersal of populations also means dispersed journey origins and destinations which does not suit the inflexible nature of rail systems on their own. The integration of urban and transport planning to increase population densities to support mass transit, as well as the integration of more flexible public transport modes with rail to increase public transport coverage, has been shown to be capable of capturing a significant proportion of urban travel.

7.12 Review of transport strategies

Through the review of various transport strategies a common theme is found; that the efficiency of urban transport systems is linked to the promotion and encouragement of sustainable transport options, including walking, cycling and public transport.

Regional and national support for rail is growing. Documentation of the advantages of rail is increasingly found in the national media and among political party policies. A growing proportion of the population are aware of the benefits rail is capable of providing in response to growing discontent at the grass roots level

over increasing traffic congestion. This has translated into a national transport strategy determined at ensuring actions are taken to secure sustainable and efficient national transport systems. Regional strategies mirror the national emphasis on sustainability and provide targets for projects in place and research into potential future projects which increase sustainable transport.

7.2 Recommendations for Waimakariri District Transport Options

Current public transport services within the Waimakariri District and connecting the Waimakariri District to Christchurch are poor. There is subsequently a high level of dependence on private motor-vehicles for the journey from the study area into Christchurch which is causing congestion on arterial routes. Predicted growth in the study area will increase levels of congestion unless transport capacities are increased. Simply increasing road capacities will further encourage dependence on motor-vehicles for Waimakariri District residents as well as the dispersal of the population within the Waimakariri District.

Alternative modes to the car should be developed within the next 2 years to change travel behaviour. Alternative modes should be given priority space on the road or through use of the existing rail corridor. Increasing public transport modal share can be achieved through priority measures as well as disincentives on car use such as higher central city parking charges. External factors such as congestion and the rising cost of petrol will also support public transport modal shares. Bus priority measures combined with an increase level of service may be used to increase the equity of transport options available to Waimakariri District residents by making bus travel a more attractive transport option. Increasing the standard of bus services should be considered a short-term solution given the location of existing rail infrastructure. Bus service improvements are currently being organised by Environment Canterbury at the expense of a slight increase in rates to help fund the service. The proposed improvements would provide a significant improvement on current services.

The integration of urban planning with sustainable transport modes is crucial as the population of the Waimakariri District grows. Increasing population densities in Rangiora, Kaiapoi and Pegasus Town would serve to support a future rail based passenger service.

The current state of the rail infrastructure relevant to the Waimakariri District is poor in terms of its potential for supporting even a basic commuter service. The Main North Line currently supports few services due to the corridor containing only one track and operating under a limited signalling system. For rail to have a significant impact on driver travel behaviour, track signalling needs to be upgraded to increase the lines capacity. The construction of a second line would significantly increase the Main North Lines capacity to support a regular passenger service, however the service would need to be supported by feeder buses operating in the Waimakariri District and Christchurch, targeting specific resident populations and destinations.

7.3 Future Planning/Investment

Immediate investment in Canterbury's rail corridors will be through the retention of all rail corridors for the future implementation of passenger rail services. The construction and reinstallation of a section of track to connect the Main North Line to the Main South Line near Addington Station would benefit existing freight and long distance commercial operations. The land on which the vital section of track would need to be laid may need to be repurchased.

Continued research into the cost of establishing rail based transport is important. As has been discussed there are alternatives to traditional light rail systems which could be a cost effective approach for the implementation of rail based passenger transport in Canterbury. Research should investigate construction and operating costs as well as the purchase of rail based stock. Construction and operating costs should be explained to residents if any funding is to come from this source. People do not understand the costs associated with the implementation of passenger rail.

A physical assessment of the current rail corridors is needed to assess what maintenance would be required on current lines to support a regular passenger rail service and to give a more accurate assessment of the cost of upgrading specific lines, especially the Main North Line across the Waimakariri River. This type of assessment would need to involve geological engineers to evaluate the stability of Christchurch's terrain for supporting extra lines where needed.

Further research into accurate Urban Transport Pricing (UTP) is imminent for New Zealand regarding the societal cost of road congestion. UTP can be used to balance the equity of national transport by providing a more accurate representation of individual's travel behaviour. For Canterbury, research should look into increasing the cost of central Christchurch parking charges which are currently too low. Any disincentives aimed at car users should be balanced by efficient alternative transport options for those being targeted.

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In memory of Missy.

References

Akerman, J. & Hojer, M. (2005). How much transport can the climate stand?-Sweden on a sustainable path in 2050. *Energy Policy*, Article in Press

Anable, J. & Gatersleben, B. (2005). All work and no play? The role of instrumental and affective factors in work and leisure journeys by different travel modes. *Transportation Research Part A*, 39, pp 163-181

Automobile Association (2005) *AA Vehicle Operation Cost*, Available from:<<http://www.gosmarter.org.nz>> [Accessed 13 March, 2006]

Bates, J., Polak, J., Jones, P. & Cook, A. (2001). The valuation of reliability for personal travel. *Transportation Research Part E*, 37, pp 191-229

Beca Carter Hollings & Ferner Ltd. (2001). *Waimakariri District Transport Study: Final Report*. Waimakariri District Council, Rangiora

Bertolini, L., le Clerq, F. & Kapoen, L. (2005). Sustainable accessibility: a conceptual framework to integrate transport and land use plan-making. Two test applications in the Netherlands and a reflection on the way forward. *Transport Policy*, 12, pp 207-220

Brand, C. & Preston, J. (2003). Which technology for urban public transport? *Proceedings of the Institution of Civil Engineers*, Transport 156, pp 201-210

Brenda Snook, (Managing Director for The Field Connection Ltd, Christchurch) 11, December, 2005

Bonnel, P. (1995). Urban car policy in Europe. *Transport Policy*, 2, pp 83-95

Burrough, P.A. & McDonnell, R.A. (1998). *Principles of Geographical Information Systems*. Oxford University Press, New York

Cervero, R. (2003). Road Expansion, Urban Growth, and Induced Travel. *Journal of the American Planning Association*, 69, pp 145-163

Curtis, C. (1997). Targeting travel awareness campaigns: Which individuals are more likely to switch from car to other transport for the journey to work? *Transport Policy*, 4, pp 57-65

- Docherty, I. & Shaw, J. (2003). *A New Deal For Transport?*, Blackwell Publishing Ltd., Oxford
- Du, H. & Mulley, C. (2006). The short-term land value impacts of urban rail transit: Quantitative evidence from Sunderland, UK. *Land Use Policy*, Article in Press
- Eichler, M. & Daganzo, C.F. (2005). Bus lanes with intermittent priority: Strategy formulae and an evaluation. *Transportation Research Part B*, Article in Press
- Environment Canterbury (2005a). Canterbury Regional Land Transport Strategy 2005-2015, Environment Canterbury, Christchurch
- Environment Canterbury (2005b). *Environment Canterbury Annual Plan 2005/06*.
- Environment Canterbury (2005c). *Metro makes moves to Waimakariri District*,
- Environment Canterbury (2005d). *Annual Monitoring Report for 2004/05: Canterbury Regional Land Transport Strategy 2002-2007*
- Environment Canterbury. (2001). *Regional Passenger Transport Plan 2001*
- F.W.C.J. van der Vooren. (2004). Modelling transport in interaction with the economy. *Transportation Research Part E*, 40, pp 417-437
- Fitzroy, F. & Smith, I. (1998). Public transport demand in Freiburg: why did patronage double in a decade? *Transport Policy*, 5, pp 163-173
- GHD (2005). *Network Level Investigative Report: Proposed Introduction of Commuter Rail Services to Christchurch City and Environs*. Environment Canterbury, Christchurch
- Gibbons, S. & Machin, S. (2005). Valuing rail access using transport innovations. *Journal of Urban Economics*, 57, pp 148-169
- Graham, S. (1996). *Always a tram in sight : the electric trams of New Zealand, 1900 to 1964*, Grantham House, Wellington

Greater Christchurch UDS. (2006). *Greater Christchurch Urban Development Strategy Forum*, Available from:< <http://www.greaterchristchurch.org.nz/Forum/>> [Accessed 29 March, 2006]

IEA (2005). *Energy and climate change: more action needed*, International Energy Agency. Available from: <http://www.iea.org> [Accessed 14 October, 2005]

Ison, S. (2000). Local authority and academic attitudes to urban road pricing: a UK perspective. *Transport Policy*, 7, pp 269-277

Jakob, A., Craig, J.L. & Fisher, G. (2006) Transport cost analysis: a case study of the total costs of private and public transport in Auckland. *Environmental Science & Policy*, 9, pp 55-66

Jefferson (1996). Improving access by public transport. *Landscape and Urban Planning*, 35, pp 173-179

Kingham, S., Dickinson, J. & Copsey, S. (2001). Travelling to work: will people move out of their cars. *Transport Policy*, 8, pp 151-160

Kuby, M., Barranda, A. & Upchurch, C. (2004). Factors influencing light-rail boardings in the United States. *Transportation Research Part A*, 38, pp 223-247

Laird, P., Newman, P., Bachelis, M. & Kenworthy, J. (2001). *Back on Track: Rethinking transport policy in Australia and New Zealand*, University of New South Wales Press Ltd, Sydney

Land Transport New Zealand (2005). *Post election briefing for the incoming Minister of Transport*, Land Transport New Zealand, Wellington

Louviere, J.J., Hensher, D.A. & Swait, J.D. (2000). *Stated Choice Methods: Analysis and Application*, Cambridge University Press, Cambridge

Luo, W. (2004). Using a GIS-based floating catchment method to assess areas with shortage of physicians. *Health & Place*. 10, pp 1-11

Levine, J. & Garb, Y. (2002). Congestion pricing's conditional promise: promotion of accessibility or mobility? *Transport Policy*, 9, pp 179-188

Mackett, R. & Edwards, M. (1998). The impact of new urban public transport systems: will the expectations be met? *Transportation Research-A*. 32, pp 231-245

- Martens, K. (2004). The bicycle as a feeding mode: experiences from three European countries. *Transportation Research Part D*, 9, pp 281-294
- Mees, P. (2000). *A Very Public Solution: Transport in the dispersed city*, Melbourne University Press, Melbourne
- Mike Blyleven, (Network Operations, Transit NZ, former ECan Transport Policy Analyst, Christchurch) 26, November, 2005
- Miles, R. (1995). *The End of the New Zealand Passenger Train*, Beynon Printing Company, Timaru
- Ministry of Transport. (2005a). *Surface Transport Costs and Charges: Main Report*.
- Ministry of Transport (2002). *New Zealand Transport Strategy*,
- Ministry of Transport (2005b). *National Rail Strategy*
- Nagai, R., Nagatani, T. & Taniguchi, N. (2005). Traffic states and jamming transitions induced by a bus in two-lane traffic flow. *Physica A*, 350, pp 548-562
- Newman, P.W.G. & Kenworthy, J.R. (1996). The land use-transport connection. *Land Use Policy*, 13, pp 1-22
- Newman, P. & Kenworthy, J. (1999). *Sustainability and Cities*, Island Press, Washington D.C.
- NZ Herald. (1997). *One track mind*, Saturday 6-12
- OECD (1996). *Towards Sustainable Transportation*, Conference Proceedings, Organisation for economic co-operation and development (OECD), Vancouver
- ONTRACK. (2005). *Annual Report*. Ministry of Transport, Wellington
- Pfleiderer, R. & Dietrich, M. (2003). New Roads Generate New Traffic. In Whitelegg, J. & Haq, G. (eds) *World Transport: Policy & Practice*. Earthscan Publications Limited, London.

Priemus, H., Nijkamp, P. & Banister, D. (2001) Mobility and spatial dynamics: an uneasy relationship. *Journal of Transport Geography*, 9, pp 167-171

Roger Sutherland, (Owner of Rail Tours NZ, Christchurch) 15, July, 2005

Scoop. (2006) *Half Million Train Passenger Journeys in Auck*, Available from:<[http:// www.scoop.co.nz](http://www.scoop.co.nz)> [Accessed on 10 April, 2006]

Salomon, I. & Mokhtarian, P.L. (1998). What Happens When Mobility-Inclined Market Segments Face Accessibility-Enhancing Policies? *Transportation Research-D*, 3, pp 129-140

Santos, G. & Bhaka, J. (2006). The impact of the London congestion charging scheme on the generalised cost of car commuters to the city of London from a value of travel time savings perspective. *Transport Policy*, 13, pp 22-33

Sinclair Knight Merz. (2004). *The Future for Public Transport in Christchurch*. Sinclair Knight Merz, Malvern

Statistics New Zealand (2001). Available from:<[http:// www.stats.govt.nz](http://www.stats.govt.nz)> [Accessed 10 October, 2005]

Stopher, P.R. (2004). Reducing road congestion: a reality check. *Transport Policy*, 11, pp 117-131

Stradling, S.G. (2002). Transport user needs and marketing public transport. *Proceedings of the Institution of Civil Engineers*, Municipal Engineer 151, pp 23-28

The Allen Consulting Group (2004). *Benefits of Investing in New Zealand's Road Infrastructure*, Sydney

UDS (2005). *So many options...which will you choose*. Greater Christchurch Urban Development Strategy. Available from: <<http://www.greaterchristchurch.org.nz>> [Accessed 3 March, 2006]

Viegas, J.M. (2001). Making urban road pricing acceptable and effective: searching for quality and equity in urban mobility. *Transport Policy*, 8, pp 289-294

Wang, F. & Luo, W. (2005) Assessing spatial and nonspatial factors for healthcare access: towards an integrated approach to defining health professional shortage areas. *Health & Place*. 11, pp 131-146

Wardman, M., Shires, J., Lythgoe, W. & Tyler, J. (2004). Consumer benefits and demand impacts of regular train timetables. *International Journal of Transport Management*, 2, pp 39-49

Wikipedia (2005). The Free Encyclopaedia, Available from:<[http:// www.wikipedia.org/wiki/Automobile](http://www.wikipedia.org/wiki/Automobile)> [Accessed 23 January, 2006]

Whitelegg, J. & Haq, G. (2003). The Global Transport Problem: Same Issues but a Different Place. In Whitelegg, J. & Haq, G. (eds) *World Transport: Policy & Practice*. Earthscan Publications Limited, London

Worldwatch Institute (2001). *Vital Signs 2001*, Earthscan, London

WBCSD (2001). *Mobility 2001: world mobility at the end of the twentieth century and its sustainability*, World Business Council for Sustainable Development. Accessed from:<[http:// www.wbscdmobility.org](http://www.wbscdmobility.org)> [Accessed 17 December, 2005]

Waimakariri District Council (2003). *District Profile*

Appendices

Appendix A Surveys and Focus Groups

A1 Phone Survey Transcript

The Field Connection Ltd



PROJECT SERVICE 2

Job No.
October 2005

Rangiora1
Kaiapoi2
Woodend3
Kainga4

Introduction

Good morning / afternoon / evening. My name is from The Field Connection, a market research company. Today / tonight we are conducting a survey within your local area about your local bus service. For this particular survey I need to speak to the person in your household over the age of 16 years whose birthday falls next.

Interviewer: If necessary make an appointment to call back at an appropriate time

Would you mind assisting please? My interview will take approximately ... minutes.

Continue Yes1
Thank & Close No2

Q.1 Firstly, could you tell me please whether or not you ever use the bus service within your local area?

Go to Q.3 Yes1
Continue No2

Q.2 If it were convenient for you to do so, how likely or unlikely would you be to consider utilising your local bus system in the future? Would you be (..read scale..) to consider utilising your local bus system in the future?

Very likely1
Quite likely2
Unsure3
Not very likely4
Not at all likely5

Go to Q.4

Q.3 On average, how often do you use your local bus service?

Daily1

- Every 2 – 3 days2
- Every 4 – 5 days3
- Once a week4
- Once very 2 – 3 weeks5
- Once a month6
- Less often than once a month ...7

Q.4a Do you currently travel into Christchurch for either work or education purposes?

- Go to Q.7**
- Yes 1
 - No2

Q.4b
you usually travel into Christchurch for either work or education purposes?

- Daily 1
- Every 2 – 3 days2
- Every 4 – 5 days3
- Once a week4
- Once very 2 – 3 weeks5
- Once a month6
- Less often than once a month ...7

Q.5 Could you tell me please where you travel to?

Write In:

Q.6a When travelling into Christchurch, what is your biggest concern?

- Rotate
- A. Increasing traffic congestion 1
 - B. The cost of travel2
 - C. Travel time3
 - D. Journey time reliability4
 - E. Other reasons write in:5
 -

Q.6b What mode of transport do you predominantly use when travelling into Christchurch?

- Bus 1
- Car2
- Bike3
- Other specify4
-

Q.7 Do you consider that the public transport system in your area should be improved?

- Continue** Yes 1
Go to Q.11a No2

Q.8 What specific aspects would you like to see improved?

Code below. Code to No

	Q.8 Improvements	Ranking
Improved frequency	1	
Improved bus quality	2	
Improved customer service	3	
Expand destinations	4	
Others Specify	5	

Q.9 If you were to rank these improvements, which of these improvements would you place first, second, third etc.?

Q.10 If bus services were improved to meet your needs within your local area, how likely or unlikely would you be to utilise the local bus service in the future? Would you be (...read scale..) to utilise the local bus service in the future?

Very likely 1
Quite likely 2
Quite unlikely 3
Very unlikely 4

Q.11a Recently a brochure relating to the consultation process for an improved Metro bus system was delivered through all letterboxes in your area. Do you recall seeing this brochure?

Yes 1
No 2

Q.11b Could you tell me if you read this brochure please?

Yes 1
No 2

Q.12a Currently Christchurch residents pay \$26 per \$100,000 of the rateable value of their home as a subsidy towards the Metro bus system. Would you be prepared to pay \$20 per \$100,000 of the rateable value of your home towards an improvement of the Metro bus system in your area?

Yes 1
No 2

Q.12b Would you be prepared to pay \$15 per \$100,000 of the rateable value of your home towards an improvement of the Metro bus system in your area?

Yes 1
No 2

Q.12c Would you be prepared to pay \$10 per \$100,000 of the rateable value of your home towards an improvement of the Metro bus system in your area?

Yes 1
No 2

Q.13a If there was a passenger rail system operating on the current rail line between Rangiora, Kaiapoi and Christchurch, if the fare met your requirements, would you consider using this service in the future?

Continue Yes 1
Go to Q.15 No 2

Q.13b And how frequently would you consider that you would utilise this service?

Daily	1
Every 2 – 3 days	2
Every 4 – 5 days	3
Once a week	4
Once very 2 – 3 weeks	5
Once a month	6
Less often than once a month ...	7

Q.14a What price would you consider to be a reasonable fare for a return trip to Christchurch by rail?

Write in:

Q.14b And what price fare for a return trip to Christchurch would you consider to be expensive enough for you to elect to utilise another mode of transport?

Write in:

Q.15 Could you tell me please why you would not consider utilising a passenger rail service to Christchurch? **Probe to No**

[illegible]

DEMOGRAPHIC PROFILE

Interviewer Code Male1
 Female2

Q.16 Finally, to ensure that we have obtained a good cross section of people in our survey, would you mind telling me please into which of the following age groups you fall?

- 16 – 19 years 1
- 20 – 29 years 2
- 30 – 39 years 3
- 40 – 49 years 4
- 50 – 59 years 5
- 60 – 69 years 6
- 70+ years 7

Q.17 And do you go out to work or business at all? Yes 1
No 2

(b) And is that full-time or part-time? Full-time 1
Part-time 2

(c) And what is your occupation please?

Write in:

Prof./ Managerial	Other White Collar	Skilled	Semi-Skilled	Retired	Housewife/ house- husband	Student/ other non- working
1	2	3	4	5	6	7

Q.18 Could you tell me please, which of the following best describes your household?

- Read Out**
- Single living with parents 1
 - Single, living alone or sharing house or flat 2
 - Couple who have no children 3
 - Couple with youngest child pre-school 5
 - Couple with youngest child still at school 6
 - Couple with all children left school, but some or all
living at home 7
 - Couple with all children living away from home 8
 - Don't know / refused 9

Q.19 And finally, which of the following brackets does your total household income fall into before taxation? **READ OUT**

- Under \$15,000 1
- \$15,001 – \$30,000 2
- \$30,001 – \$50,000 3
- \$50,001 – \$70,000 4
- \$70,001 – \$90,000 5
- \$90,001 – \$100,000 6
- \$100,000 plus 7

Q.20 And could I please check which township you live in?
Rangiora 1
Kaiapoi 2
Woodend 3
Kainga 4

Q.21 Could you tell me which street you live in please?

Write in:


Thank you very much for your help with this survey. If you have any queries at all please contact our Field Manager on 366-0170 during office hours. Again thank you for your assistance, and my name is

Telephone Number:

Interviewer:

Date:

A1 Environment Canterbury public consultation brochure



Metro makes moves to Waimakariri District

Metro makes moves to Waimakariri District

A significantly improved public transport service could be less than a year away for residents of Waimakariri District. Thanks to proposed improvements receive sufficient support from residents in Rangiora, Kaiapoi, Woodend and Waiuku.

Recent consultation over the future of public transport services for Waimakariri District residents has involved:

- Meeting with councillors and community boards;
- Sending letters to residents;
- Conducting a phone survey; and
- Holding a series of focus groups with residents.

Feedback from Waimakariri residents has sent a clear message – 15 mins for improvements to be made to public transport services. Residents say they've seen how good the Metro service is in Christchurch with its new buses, higher frequency services, timetable and route information at bus stops, and lower fares with Metro card.

Residents committing to work in Christchurch pay around \$50 a week in public, and would like to travel by public transport. Yet the present cost of \$90 per week to travel by bus (\$12 per day return fare), doesn't make it attractive enough. Comments tell us they'd use public transport if:

- fares were lower;
- routes were more direct providing a faster service;
- better information was provided at stops; and
- services were more frequent to give them more choice about when they travel.

Based upon residents' feedback, an improved Metro style service is being proposed for Waimakariri District. This brochure outlines the proposed service improvements and asks residents to choose either this new service or retaining the existing service.

If residents in Waimakariri District want Metro style services, some increases in fares is inevitable. It's important that you read this brochure, consider the options and give us your feedback.

What are the choices?

There are 2 options to choose between:

Option A: Status Quo

The existing bus services remain the same, with no changes to routes, frequency or fares.

- The service continues to take around 60 minutes to travel from Rangiora to Christchurch Central City
- A service every 90 minutes on weekdays and every 2 hours during the weekend
- Current fares from Rangiora to Christchurch remain

From/to	One Way	Return Trip		
Christchurch	Cash	Midroad	Cash	Midroad
Kaipoi	\$4	\$8	\$8	\$8
Woodend	\$5.50	\$4.50	\$11	\$9
Rangiora	\$6	\$5.25	\$12	\$10.50

Now turn over the brochure and consider Option B.

Freepost 1201



Free



Metro Service Review
Passenger Services Manager
Environment Canterbury
PO Box 345
CHRISTCHURCH

Freepost Feedback Form

Have your say by writing your comments below. Then tear off this feedback form to stamp required and send it to us by Friday 18 November 2005.

Q. Which option do you prefer?

☐ Option A – Status Quo – no changes

☐ Option B – Improved Metro style service with cheaper fares, more services and faster trips

Q. Are there other improvements you'd like to see?

Q. Do you currently use public transport more than once a month?

☐ Yes ☐ No

Q. Do you want to be kept informed about public transport?

☐ Yes ☐ No

Name: _____

Address: _____

Email: _____

Thank you for your feedback. Now please tear off this form and post it to us.

As part of a University of Canterbury research project, could you please answer these additional questions:

Q. What is currently your main mode of transport?

Q. Would you consider switching to use rail?

Q. Where is the main destination you commute to?

Please name and address precisely

Option B: Metro style service

The existing bus services would be significantly overhauled with improvements such as:

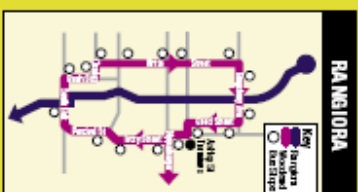
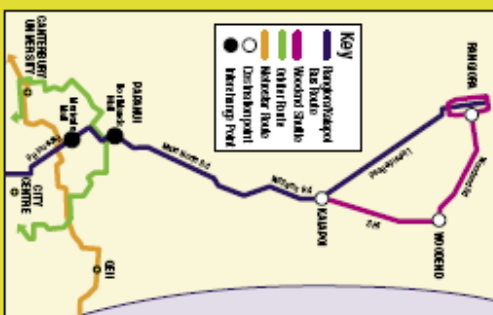
- A more direct route (see accompanying map)
- Shorter travelling time from Rangiora to Christchurch
- A service every 30 minutes on weekdays 7am-6pm and on Saturdays 8am-6pm; an hourly service on Sundays and in evenings
- Hourly shuttle service for Woodend providing links to Rangiora and Kaiapoi
- Greater flexibility for passengers with more frequent service
- Metro style timetable information at stops, more seats and shelters
- Reduced fares mean a return trip costs under \$10 from Rangiora to Christchurch Central City using a Metrocard

From/to	One Way	Return Trip
Christchurch	Cash Metrocard	Cash Metrocard
Kaiapoi	\$3.50 \$2.00	\$7 \$5.20
Woodend	\$5 \$3.75	\$10 \$7.50
Rangiora	\$5 \$3.75	\$10 \$7.50

Option B would require an increase in household rates in areas serviced by these routes.



Waimakariri Bus Routes Option B



Introducing Metrocard

The Metrocard, introduced in 2003, gives passengers a discount on the cost of cash fares. Metrocard is easy to use. You load cash in \$10 amounts onto your Metrocard and as you board the bus, simply place your Metrocard on the reader machine and it deducts your fare.

For passengers travelling between Rangiora and Christchurch, Metrocard could save you \$1.25 on each trip or \$12.50 per week. After a year using Metrocard you could save as much as \$600! With great savings like these, it's easy to understand why over 75,000 Metrocards have been issued already.

To find out about discount fares and to apply for a Metrocard:

- Visit Metroinfo in the Exchange, Monday to Friday 7.30am – 5.50 pm, Saturday 9am – 5.30pm and Sunday 9.30am – 5.30pm
- Or phone Metroinfo on 386 88 55, Monday to Saturday 8.30am – 10.30pm and Sundays 9am – 5pm

Improvements will come at a cost

Maintenance of the existing service (option A), may require a residents' contribution of approximately \$10,000 per \$100,000 capital value. For the improved service offered under option B, 120 minutes frequency, this would require approximately \$20,000 per \$100,000 capital value. In contrast, Christchurch residents currently pay \$25.91 per \$100,000.

Please note, city households in the urban areas would be rated for public transport services. It does not apply to house holds in rural areas.

Which option do you prefer?

It's time for you to have your say. Tell us which option you prefer on the attached feedback form and return it to us no later than Friday 18 November 2005. If there is support for these improvements, they could be introduced in 2006.

A1 Focus group topic guide

INTRODUCTION

Introductions

Format for the evening

Market Research Society Code of ethics

CURRENT USAGE AND ATTITUDES

- Identify current transport modes and reasons for usage
- Identify thoughts and feelings on current passenger transport services
- Exploration of transportation mode culture i.e car ownership levels etc

S.W.O.T. ANALYSIS OF RAIL PASSENGER SERVICES

- Exploration of thoughts and feelings related to rail services
- Exploration of perceived strengths of a rail passenger service in Christchurch
- Exploration of perceived weaknesses of a rail passenger service in Christchurch
- Exploration of perceived opportunities of a rail passenger service in Christchurch
- Exploration of perceived threats to a rail passenger service in Christchurch
- Identify key benefits of a rail passenger service

THE IDEAL RAIL PASSENGER SERVICE

- Exploration of the ideal rail passenger service – holistic package including infrastructure
- Exploration of frequency of schedule
- Exploration of communication tools required within an integrated system
- Exploration of thoughts and feelings related to electric trains vs diesel trains
- If not freely mentioned explore – park and ride – cycle and ride – walk and ride
- Exploration of perceived potential cost benefits related to fuel and car-parking costs increasing in the future
- Exploration of perceptions of time savings, if any, to be made

ISSUES RELATED TO A RAIL PASSENGER SERVICE

- Exploration of perceived impact on other modes of transport
- Exploration of perceived impact related to rail crossings on primary routes
- Exploration of the perceptions of trains going through residential areas
- Exploration of perceptions of people changing house/buying houses to be near train stations
- Identify additional information that respondents would require
- Exploration of potential uptake if the ‘ideal’ were to be implemented in the future

Other areas as appropriate

Appendix B: Results Analysis

B1 Example of Journey to work data in a CAU to CAU matrix

Total trips from Waimak by CAU code, excluding trips to unspecified CAUs (districts, all NZ etc)

Sum of Total		ToCAUCode					
FromCAUcode	CAU Usual Residence	580900	581400	581500	585502	585503	585504
585805	Sefton	0	0	0	0	0	0
585808	Ashley	0	0	0	0	0	3
586002	Pines-Kairaki Beach	0	0	0	0	0	0
586112	Waikuku	0	0	0	0	0	0
586114	Cust	0	0	0	0	0	0
586115	Mairaki	0	0	0	0	0	0
586116	Fernside	0	0	0	0	0	0
586117	Tuahiwi	0	0	0	0	0	0
586118	Coldstream	0	0	0	0	0	0
586120	Woodend	0	0	0	3	0	0
586301	Rangiora North	0	0	0	0	0	0
586302	Rangiora West	0	0	0	0	0	0
586303	Rangiora East	0	0	0	0	0	0
586304	Southbrook	0	0	0	0	0	0
586401	Kaipoi North	0	0	0	0	0	0
586402	Kaipoi South	0	0	0	0	3	0
586501	Clarkville	0	0	0	0	0	0
586502	Kaipoi West	0	0	0	0	0	0
586601	West Eyreton	0	0	0	0	0	0
586602	Eyreton	0	0	0	0	0	3
586801	Ashley Gorge	0	0	0	0	0	0
586802	Oxford	0	0	0	0	0	0
Grand Total		0	0	0	3	3	6

B2 Automobile Association Operating and Running Costs

AA Vehicle Operation Cost				
<< Car Costs				
AA Vehicle Operation Cost				
Petrol driven vehicles estimated on 14,000km per year, first five years of ownership				
Engine Capacity	Up to 1300cc	1301 - 1600cc	1601 - 2000cc	Over 2000cc
Average price of a new car including registration	\$19,662	\$28,065	\$36,936	\$42,356
A – FIXED COSTS				
Average value at start of 3 rd year	\$14,441	\$20,612	\$27,128	\$31,108
Annual relicensing	\$217	\$217	\$217	\$217
Insurance – Comprehensive, no claim	\$540	\$665	\$805	\$825
Warrant of fitness annually at \$34 for first 6 years	\$34	\$34	\$34	\$34
Total Outlay	\$15,232	\$21,529	\$28,184	\$32,185
Interest on outlay at 8.2%	\$1,249	\$1,765	\$2,311	\$2,639
Capital cost (outlay + interest)	\$16,481	\$23,294	\$30,495	\$34,824
Depreciation (at 14.3% from average value) at 3 rd year	\$2,065	\$2,948	\$3,879	\$4,449
Depreciated value	\$12,376	\$17,665	\$23,248	\$26,660
TOTAL FIXED COSTS	\$4,105	\$5,629	\$7,247	\$8,164
Fixed Cost per Day	\$11.25	\$15.42	\$19.85	\$22.37
B – RUNNING COSTS				
Petrol – Litres used per 100km	5.9	7.2	8.6	10.8
Litres used over 14,000km	966	1009	1204	1512
Cost at \$1.09 per litre (January 2003)	\$1,056.80	\$1,103.85	\$1,317.18	\$1,654.13
Oil at \$7.82 per litre (1 litre per 2,500km = 5.6 litres used)	\$43.74	\$43.74	\$43.74	\$43.74
Tyres estimated life of 40,000km – cost per year	\$157.78	\$182.65	\$224.99	\$229.83
Repairs and maintenance (incl. service oil changes)	\$732.95	\$724.90	\$777.97	\$879.21
TOTAL RUNNING COSTS	\$1,991.27	\$2,055.13	\$2,363.87	\$2,806.91
Running Cost per Kilometre	14.2c	14.7c	16.9c	20.0c
A+B FIXED COSTS PLUS RUNNING COSTS	\$6,097	\$7,684	\$9,611	\$10,971
Divided by 14,000km = Cents per km operating cost	43.5c	54.9c	68.6c	78.4c
Extended operating costs covering 10,000, 14,000 and 40,000km per year				
Kilometres per year	Cents per km operating cost			
10,000km	53.2c	65.7c	84.2c	\$1.05c
14,000km	43.5c	54.9c	68.6c	78.4c
40,000km	24.0c	27.9c	34.0c	41.8c

